# Logic Analyzer System
# LAM 4850 A

dli DOLCH
LOGIC INSTRUMENTS GMBH

DOLCH
LOGIC INSTRUMENTS

# OPERATOR'S MANUAL
# FOR
# LAM 4850A

PUBLICATION NUMBER: 78343N

DOLCH
LOGIC INSTRUMENTS

# PRODUCT IDENTIFICATION SHEET

Model # _____

Date Shipped _____

Software Revision Level _____

Serial Number _____

Options Installed:

- ☐ HMS 300-High Speed Overlay Memory
- ☐ ETT 12-Extended Trigger and Trace
- ☐ TSO 16-Time Stamp Option
- ☐ ME 4K-4K Memory Extension
- ☐ HTO 48 Hardware Test Option

# FOREWORD

This manual uses the "exploded block" concept whereby functional, as well as physical descriptions correspond to an overall diagram that arranges subsystems into functional blocks. Thus, the general description of a block in the overall diagram is expanded to more detail in another section. The order of blocks is maintained from one explanation level to the next.

Detailed functional blocks and figures are shown with keys to text in cases where a higher level explanation is further expanded. Operational procedures are presented as flowcharts, that show the step-by-step sequence of actions to be done by the operator along with responses expected from the Logic Analyzer. These flowcharts may also be keyed to supporting text.

This "Operator's Manual, Volume 1" provides theoretical and operational information on the LAM 4850A. It is separated into the following sections:

- General Description
- Unpacking and Installation
- Functional Description/Theory of Operation
- Controls and Displays
- Operating Procedures

Other options, accessories, and modifications are covered by change pages or inserts as necessary.

For detailed theory of operation and repair procedures see the LAM 4850A "Service Manual, Volume 2".

## CHANGES TO THIS MANUAL

This manual will be changed periodically to keep it current with improvements as we make them. Changes start with Service Notes that alert field service technicians to critical problem areas and changes in maintenance procedures. After a series of these notes are issued or a critical one is issued, we will publish change pages. which are the remove-the-old and insert-the-new type. When the company prepares a change package. it sends announcements to its users. The change packages are available upon request and without charge.

### Record of Changes

The record of Changed Pages lists all the pages in this book. that are deleted. changed pages, added pages, and foldout pages.

### Reader Comment Form

We have supplied the reader comment form (at the back of this manual) to get feedback from our customers. If you are dissatisfied with this publication, we want to hear from you. Tell us about inaccurate information. typographical errors, or missing information. If you know a way to improve a procedure. please let us know about that. too. When filling out the form. please be specific and give the page number. line reference, and the paragraph number. if possible.

## RECORD OF CHANGES

| CHANGE NUMBER | DATE | TITLE OR BRIEF DESCRIPTION | ENTERED BY (NAME, DEPT.) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## SAFETY PRECAUTIONS

As with any electronic equipment, precautions consistent with all standard industrial safety practices must be observed while servicing this equipment since it contains potentially lethal voltages. Any servicing that requires removing cabinet covers should be performed by qualified service personnel. Always disconnect power prior to inspection or servicing.

Admonishments are included throughout this manual to alert the reader to problem areas or situations that could cause loss of data, hardware damage, or personal injury.

A WARNING statement precedes the text of procedures that, if not strictly observed, could result in fatal injury to the service technician. A CAUTION statement precedes the text of a procedure that, if not strictly observed, could result in damage or destruction of equipment (hardware or software). A NOTE statement highlights essential operating or maintenance procedures, conditions, or clarifying facts. NOTEs also provide information that, though not necessary, is helpful to the understanding of a concept or the completion of a procedure.

NOTE:

This device conforms to safety class I as per IEC 348.

## WARRANTY

All Dolch Instruments products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, per exceptions as noted in the price lists. In the event of a breach of Dolch Instruments warranty, Dolch Instruments shall have the right in its discretion either to replace or repair the defective goods. There shall be no other remedy for breach of the warranty. In no event shall Dolch Instruments be liable for the cost of processing, lost profits, injury to goodwill, or any special. consequential or incidental damages. The foregoing warranty is exclusive of all other warranties. whether expressed or implied, including any warranty or merchantability or fitness for a particular purpose.

TABLE OF CONTENTS


| | | |
|---|---|---|
| SECTION 1 - | GENERAL DESCRIPTION | 1-1 |
| 1.1 | Introduction | 1-1 |
| 1.2 | Equipment Description | 1-1 |
| 1.2.1 | Data Aquisition | 1-1 |
| 1.2.2 | Input Sensing | 1-1 |
| 1.2.3 | Pod Assignments | 1-1 |
| 1.2.4 | Personality Probes | 1-1 |
| 1.3 | System Configuration | 1-1 |
| 1.4 | Reference Data | 1-5 |
| 1.5 | Description of Symbols, Codes and Abbreviations | 1-5 |
| SECTION 2 - | UNPACKING AND INSTALLATION | 2-1 |
| 2.1 | General | 2-1 |
| 2.2 | Unpacking | 2-1 |
| 2.3 | Warranty Information | 2-1 |
| 2.4 | Pre-Power Procedures | 2-2 |
| 2.4.1 | Installation | 2-2 |
| 2.4.2 | Power Requirements | 2-2 |
| 2.5 | Initial Turn-On / Check-Out Procedures | 2-2 |
| 2.6 | Turn-Off Procedure | 2-3 |
| 2.7 | Repacking For Shipment | 2-4 |
| SECTION 3 - | FUNCTIONAL DESCRIPTION / THEORY OF OPERATION | 3-1 |
| 3.1 | General | 3-1 |
| 3.2 | Overall Hardware Function Diagram | 3-1 |
| 3.2.1 | Input Function | 3-1 |
| 3.2.2 | Clocking Function | 3-1 |
| 3.2.3 | Memory Block | 3-2 |
| 3.2.4 | Triggering/Trace Control Function | 3-2 |
| 3.2.5 | Microprocessor Control Function | 3-2 |
| 3.2.6 | Operator Input Function | 3-3 |
| 3.2.7 | Display Function | 3-3 |
| 3.2.8 | Remote Control Function | 3-3 |
| 3.2.9 | Optional Function | 3-3 |
| 3.2.10 | Internal Communication Bus | 3-3 |
| 3.3 | Overall Operating Sequence | 3-3 |
| 3.3.1 | Pre-Record Programming Mode | 3-4 |
| 3.3.2 | Data Recording Mode | 3-5 |
| 3.3.3 | Data Analysis Mode | 3-5 |
| 3.3.4 | File Manipulation Mode | 3-6 |
| SECTION 4 - | CONTROLS AND DISPLAYS | 4-1 |
| 4.1 | General | 4-1 |
| 4.2 | Controls | 4-1 |
| 4.2.1 | Backpanel Controls | 4-1 |
| 4.2.2 | Data Aquisition Connectors | 4-1 |
| 4.2.3 | Keyboard | 4-1 |
| 4.3 | Menus | 4-15 |
| 4.4 | Displays | 4-32A |
| 4.5 | Monitors | 4-32A |

TABLE OF CONTENTS


SECTION 5 - OPERATING PROCEDURES 5-1
5.1 General 5-1
5.2 Basic Programming Rules 5-1
5.2.1 Bracket Input Types 5-1
5.2.2 Range Selection Input Types 5-2
5.2.3 Non-Bracketed Input Types 5-2
5.2.4 How To Reach Parameters 5-2
5.2.5 How To Call Menus And Displays 5-4
5.3 Pre-Record Programming Mode 5-4
5.3.1 Trace Menu Operational Theory 5-4
5.3.2 Trace Menu Operating Procedures 5-11
5.3.3 Trigger Menu Operational Theory 5-16
5.3.4 Trigger Menu Operating Procedures 5-18
5.3.5 Compare Menu Operation Theory And Procedures 5-23
5.3.6 Option Table Operation 5-29
5.3.7 Set-Up Monitor 5-29
5.4 Data Recording Mode 5-30
5.4.1 Trace/Trigger Monitor Operation 5-30
5.5 Data Analysis Mode 5-32
5.5.1 Timing Diagram Analysis 5-32
5.5.2 Timing Diagram Memory Functions 5-34
5.5.3 Timing Diagram Search Functions 5-37
5.5.4 List Display Analysis 5-44
5.5.5 List Display Memory Functions 5-46
5.5.6 List Display Search Functions 5-47
5.5.7 Data Analysis Options 5-54
5.6 File Manipulation Mode 5-54
5.6.1 Scratch Table Operating Notes 5-54
5.6.2 Store File Operation 5-55
5.6.3 All States Store 5-55
5.6.4 Recall File Operation 5-55
5.6.5 All States Recall 5-55

# LIST OF ILLUSTRATIONS


| FIG/NO | | PG/NO |
|---|---|---|
| 1-1 | LAM 4850A - Front View | 1-2 |
| 1-2 | LAM 4850A - Rear View | 1-3 |
| 1-3 | Typical Configuration | 1-4 |
| 2-1 | Unpacking Sequence | 2-1 |
| 2-2 | Installation Steps | 2-2 |
| 2-3 | Turn-on | 2-3 |
| 3-1 | LAM 4850A - Top View | 3-7 |
| 3-2 | Overall Hardware Function Diagram | 3-8 |
| 3-3 | Overall Operating Sequence | 3-9 |
| 4-1 | Controls, and Indicators Overall View | 4-2 |
| 4-2 | Back Panel Controls and Connectors | 4-3 |
| 4-3 | Data/Clock Connectors | 4-6 |
| 4-4 | Keyboard Display, Specify. Cursor and Trace | 4-7 |
| 4-5 | Keyboard Entry and Edit Groups | 4-11 |
| 4-6 | Menu Access | 4-15 |
| 4-7 | LAM 4850A Menus | 4-16 |
| 4-8 | Trace Menu | 4-17 |
| 4-9 | Trigger Menu | 4-23 |
| 4-10 | Trigger Word Definition Menu | 4-25 |
| 4-11 | Compare Menu | 4-27 |
| 4-12 | Scratch Table | 4-31 |
| 4-13 | Option Table | 4-31 |
| 4-14 | Display Access | 4-33 |
| 4-15 | Monitor Access | 4-32A |
| 4-16 | Timing Diagram | 4-34 |
| 4-17 | Sequence Search Menu | 4-40 |
| 4-18 | Timing Diagram Word Search | 4-42 |
| 4-19 | List Display | 4-44 |
| 4-20 | List Display Word Search and Sequential Search | 4-48 |
| 4-21 | Trace/Trigger Monitor | 4-50 |
| 4-22 | Set-up Monitor Displays | 4-52 |
| 5-1 | Overall Functional Family Tree | 5-60 |
| 5-2 | Input Types | 5-1 |
| 5-3 | Bracket Type Inputs | 5-2 |
| 5-4 | Range Selection Input | 5-2 |
| 5-5 | Non-Bracket Input | 5-2 |
| 5-6 | How to reach Parameters | 5-3 |
| 5-7 | Trace Menu Functional Block | 5-10 |
| 5-8 | Sampling Modes | 5-5 |
| 5-9 | Memory Block Configurations | 5-6 |
| 5-10 | Memory Formats Displays | 5-6 |
| 5-11 | Trigger Word | 5-7 |
| 5-12 | Pod Skew | 5-7 |
| 5-13 | Threshold Adjust | 5-8 |

## LIST OF ILLUSTRATIONS


| | | |
|---|---|---|
| 5-14 | Clock Source Programming | 5-8 |
| 5-15 | Slope and Qualifiers | 5-9 |
| 5-16 | Trace Menu Keys | 5-11 |
| 5-17 | Trace Menu Operation | 5-12 |
| 5-18 | Trigger Menu | 5-16 |
| 5-19 | Trigger Word Definition Menu | 5-16 |
| 5-20 | Trigger Menu Operation | 5-19 |
| 5-21 | Trigger Word Definition Menu Operation | 5-21 |
| 5-22 | Compare Menu Keys | 5-24 |
| 5-23 | Compare Menu Formats | 5-24 |
| 5-24 | Range of Compare | 5-25 |
| 5-25 | Skew and Channel Groups | 5-25 |
| 5-26 | Compare Modes | 5-26 |
| 5-27 | Compare Menu Operation | 5-27 |
| 5-28 | Option Selection | 5-29 |
| 5-29 | Trace/Trigger Monitor Operation | 5-30 |
| 5-30 | Timing Diagram Elements | 5-35 |
| 5-31 | Timing Diagram Channel Arrangement | 5-36 |
| 5-32 | Timing Diagram Memory Selection | 5-34 |
| 5-33 | Timing Diagram Search Selection | 5-37 |
| 5-34 | Timing Diagram Search | 5-38 |
| 5-35 | Executing Search in Timing | 5-43 |
| 5-36 | List Display Operation | 5-45 |
| 5-37 | List Display Memory Selection | 5-46 |
| 5-38 | List Display Search Selection | 5-47 |
| 5-39 | List Display Search | 5-48 |
| 5-40 | Executing Search in List | 5-52 |
| 5-41 | Scratch Table Organization | 5-54 |
| 5-42 | Store File Operation | 5-56 |
| 5-43 | Recall File Operation | 5-58 |

# LIST OF TABLES


| | | |
|---|---|---|
| TABLE 1-1. | Equipment Specifications | 1- 6 |
| TABLE 1-2. | Equipment, Accessories, and Documents supplied | 1-11 |
| TABLE 1-3. | Symbols | 1-12 |
| TABLE 1-4. | Codes and Abbreviations | 1-14 |
| TABLE 4-1. | Back Panel Controls and Connectors | 4- 4 |
| TABLE 4-2. | Display, Specify, Cursor, and Trace Groups | 4- 8 |
| TABLE 4-3. | Entry and Edit Groups | 4-11 |
| TABLE 4-4. | Trace Menu Elements | 4-18 |
| TABLE 4-5. | Trigger Menu Elements | 4-24 |
| TABLE 4-6. | Trigger Word Definition Menu Elements | 4-26 |
| TABLE 4-7. | Compare Menu Elements | 4-28 |
| TABLE 4-8. | Scratch Table Elements | 4-32 |
| TABLE 4-9. | Timing Diagram Elements | 4-35 |
| TABLE 4-10. | Sequential Search Display Elements | 4-41 |
| TABLE 4-11. | Timing Diagram Search Word Display Elements | 4-43 |
| TABLE 4-12. | List Display Elements and Sequential Search | 4-45 |
| TABLE 4-13. | List Display Search Word Elements | 4-49 |
| TABLE 4-14. | Trace / Trigger Monitor Elements | 4-51 |
| TABLE 5-1. | Trigger Menu Functions | 5-17 |
| TABLE 5-2. | Sample Clock | 5-18 |

SECTION 1

GENERAL DESCRIPTION

## 1.1 INTRODUCTION

The LAM 4850A is a modular logic analyzer designed around three independent 16 channel recording blocks Single Board Logic Analyzer (SBLA's). This architecture provides maximum flexibility and performance. The LAM 4850A is shown in Figure 1-1. Various interface and control configurations are built-in, and optional functions are also available as firmwared plug-ins.

## 1.2 EQUIPMENT DESCRIPTION

The LAM 4850A is housed in a metal casing which features a large handle that doubles as a stand for test bench applications. Connectors for data and clock inputs are provided on the front panel. The front panel also contains a keyboard for system control, a power on line LED indicator, a CRT, and an intensity adjustment potentiometer for the CRT.

The back panel contains the power switch, fuse, control and monitoring interface connectors, and trigger outputs. See Figure 1-2 for details.

### 1.2.1 Data Aquisition

Data from the system under test (SUT) is inputed through the front panel connectors. External clocks and qualifiers are also applied at this point. This allows for multiple input sensing configurations and other special probe use.

### 1.2.2 Input Sensing

All signals are sensed through a high impedance (1 M Ohm/-10 pF, measured at probe tip) custom hybrid circuit. Four of these circuits are housed in an Active Logic Probe (ALP 44), which can be used stand-alone or mechanically linked to other ALP's. The input signals are compared to a threshold level as programmed in the TRACE MENU. Signals higher than the threshold level are shown as logical "1", and signals lower than the threshold level are shown as logical "0".

### 1.2.3 Pod Assignments.

There are six ( A, B, C, D, E, F ) data input groups, each 8 bits wide. These groups are divided into two probe connectors labelled 3-0 and 7-4 corresponding to the lower and upper nibbles of the 8 bit input byte. Signal input probes, each labelled diffe rently, are supplied with the instrument. All probes are electrically identical and can be interchanged without restriction.

External clocks and corresponding clock qualifier signals are connected through the same type of probes as data signals. The external clock inputs are labelled "CLK". Numbers 1, 2, and 3, as designated in the TRACE MENU.

### 1.2.4 Personality Probes.

For special multi-channel setups the ALP's can be replaced by personality probes available for most microprocessors, IEEE-Bus, and serial interfaces.

The personality probe is connected by a single clip or connector to the SUT. The probe organizes and generates control signals necessary for a clear display and/or disassembly listing.

## 1.3 SYSTEM CONFIGURATION

A typical configuration for the LAM 4850A is shown in Fig. 1-3. This figure shows the LAM 4850A with ribbon connectors from the front panel data inputs to an assortment of ALP 44, which are connected to desired test points. In this figure an external clock is connected to input "3". A TIMING DIAGRAM is present on the CRT that shows actual time measurement.

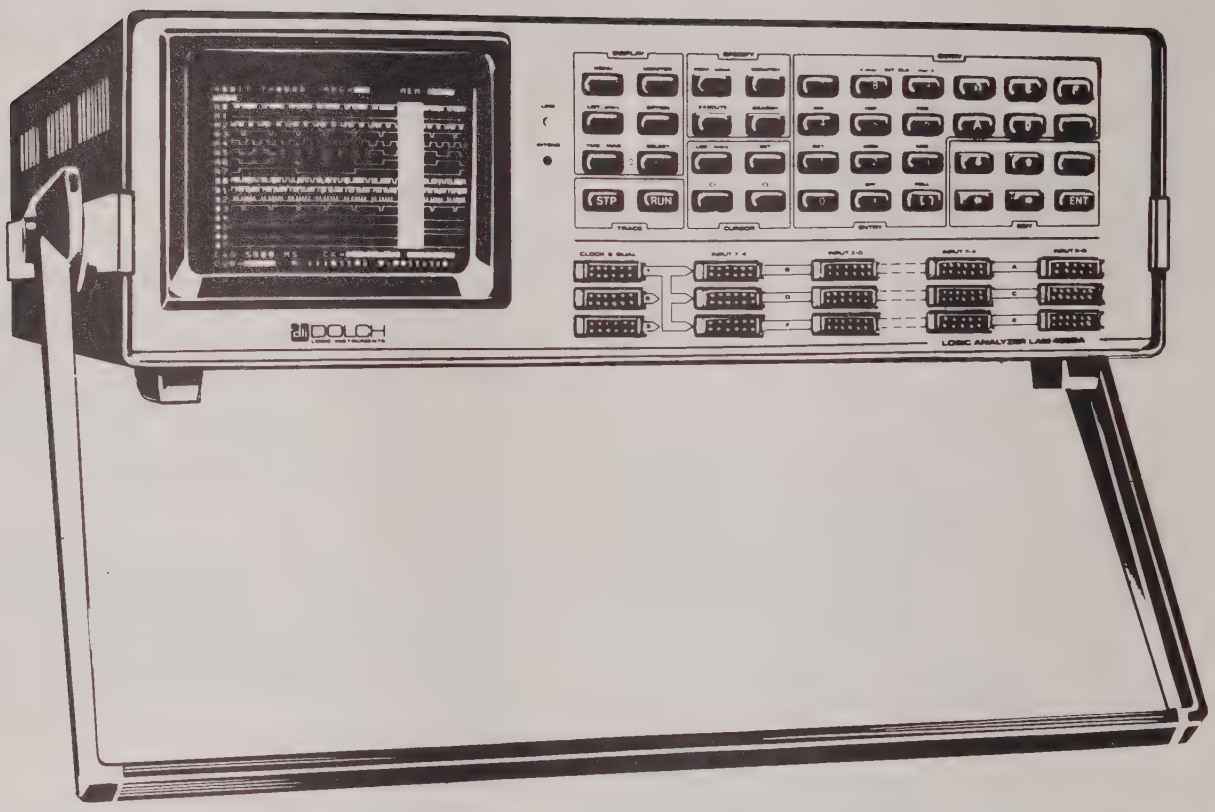



FIGURE 1-1. LAM 4850 A - FRONT VIEW

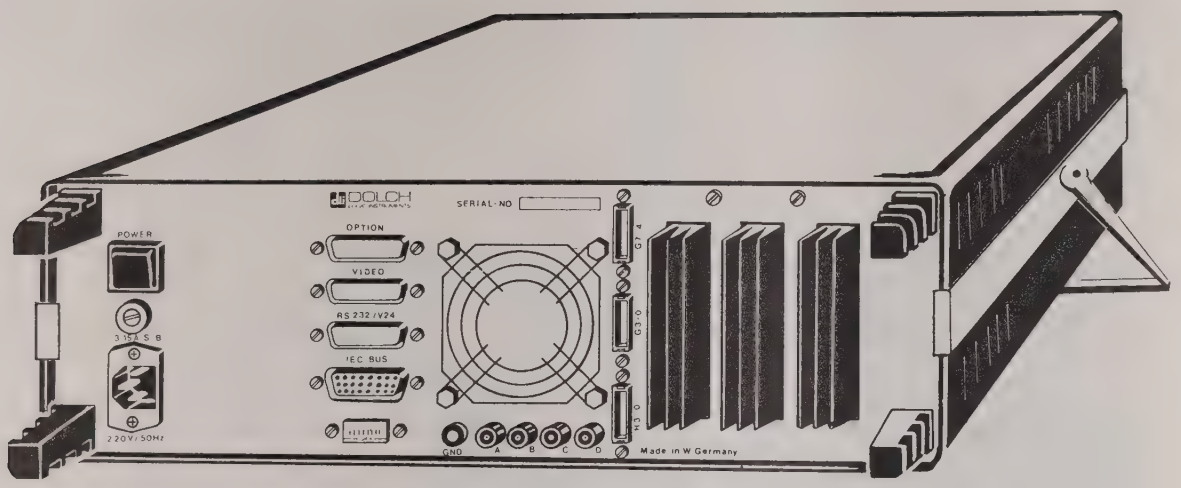



FIGURE 1-2. LAM 4850 A - REAR VIEW

FIGURE 1-3. TYPICAL CONFIGURATION

## 1.4 REFERENCE DATA

Reference data is divided into two parts: Equipment Specifications and Equipment, Accessories, and Documents Supplied.

Table 1-1, Equipment Specifications provides a tabular listing of:

- Nameplate Data
- Power Requirements
- Functional Characteristics
- Dimensions
- Environmental Characteristics
- Electrical Characteristics

Table 1-2, Equipment, Accesories, and Documents Supplied provides a tabular listing of:

- Quantity
- Model Number
- Name
- Description

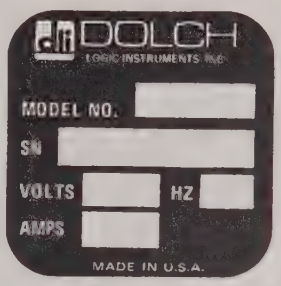
## 1.5 DESCRIPTION OF SYMBOLS, CODES AND ABBREVIATIONS

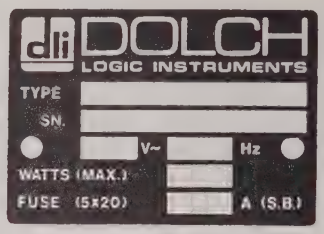
Table 1-3 shows a listing of the various symbols used throughout this manual for functional block diagrams and simplified circuit diagrams.

Table 1-4 provides an explanation of codes and abbreviations used throughout the documentation in text as well as block diagrams.

Table 1-1. EQUIPMENT SPECIFICATIONS

NAME PLATE DATA:




| | | |
|---|---|---|
| POWER REQUIREMENTS: | VOLTAGE | 110 or 220 VAC (+10%/-25%); (Pre-Set at factory) |
| | FREQUENCY | 47-63 Hz. |
| | WATTAGE | 230 W Maximum |
| | BATTERIES (2) | G.E. Data Sentry Ni-Cad. 3.6V |
| | FUSING | 110 V - 2 Amps (Slow/Blow)<br>220 V - 1 Amp (Slow/Blow) |
| FUNCTIONAL CHARACTERISTICS: | APPLICATION | Logic analysis of microprocessor based and other digital systems. Provides for input, sampling, tracing, triggering, recording, comparison, search, memory control, file manipulation, and display of all digitally based functions. |
| | SIGNAL INPUTS (4850A and ALP 44) | Number-60: 48 data, 3 external clocks, and 9 clock qualifiers<br>Impedance - 1M Ohm/10pF at probe tip. |

Table 1-1. EQUIPMENT SPECIFICATIONS (continued)

| | | |
|---|---|---|
| FUNCTIONAL CHARACTERISTICS: | | Threshold - TTL (Preset to + 1.4 V)<br>ECL (Preset to - 1.3 V)<br>V1 + V2 programmable from -9.9 V to +9.9 V in 0.1 volt increments. (Pre-Set to + 2.9 Volts) |
| | SAMPLING FUNCTIONS | Internal Clock - 20 ns to 500 ms<br>External Clocks - 3<br>Ext. Clock Rate - DC to 50 MHz<br>Setup Time - Data 15 ns before active clock edge.<br>Hold Time - Data stable 2 ns after active clock edge.<br>Qualifiers - 3<br>Simultaneous Clock - Independent internal or external programmed "OR" function available<br>Latch Mode - 5 ns with 250 millivolts threshold overdrive. |

Table 1-1. EQUIPMENT SPECIFICATIONS (continued)

| | | |
|---|---|---|
| FUNCTIONAL CHARACTERISTICS: | TRIGGERING FUNCTIONS | Sequential Trigger - 12 Levels.<br>Word Size - Up to 48 bits wide.<br>Code Selection - Triggerwords may be specified as:<br>• Binary<br>• Hex<br>• Octal<br>• Positive<br>• Negative<br>Pass Counters - User programmable event counter on each level from 1 to 255 counts.<br>Recording Delay- 0-8192 counts of internal or external clock before recording is stopped. |
| | TRIGGER AND TRACE MONITOR | Pretrigger Sampling<br>Trigger Tracing<br>Trigger Delay<br>Slow Clock(s) |
| | SOURCE AND REFERENCE MEMORIES: | Size - 48 bits by 1000 words (Source) and 48 bits by 1000 words (Reference memory) |

Table 1-1. EQUIPMENT SPECIFICATIONS (continued)

| | | |
|---|---|---|
| FUNCTIONAL CHARACTERISTICS: | | Organization - 1K Format 3 blocks 16 x 1K words.<br><br>2K Format 1 block, 16x 2K words and 1 block, 16x 1K words. |
| | FILE MANIPULATION | Scratch Table - Configuration storage with three months battery backup. |
| | COMPARE FUNCTIONS | Halt If - R=S, R≠S<br>Count If - R=S, R≠S<br>Compare Limits - Portions of Source Memory can be compared to Reference Memory.<br><br>Compare Skew - Bit and Byte comparison. |
| | SEARCH FUNCTIONS | S = R<br>S ≠ R<br>Sequence Word |
| DIMENSIONS: | SIZE | |

| Height | Width | Depth | |
|---|---|---|---|
| 137 | 441 | 481 | mm |
| 5.4/10 | 17.4/10 | 18.9/10 | in. |

| | | |
|---|---|---|
| | WEIGHT | 20 kg (44 lbs) including standard accessories (15 ALP 44,1 manual) |

Table 1-1. EQUIPMENT SPECIFICATIONS (continued)

| | | |
|---|---|---|
| ENVIRONMENTAL CHARACTERISTICS: | OPERATING TEMPERATURE | Range from 0 to 50 degrees Centigrade ambient temperature |
| ELECTRICAL CHARACTERISTICS: | MAXIMUM VOLTAGE | +/- 50 Volts continous; +/- 250 Volts transient |
| | VIRTUAL GROUND | Continous GND potential differences up to +/- 5 Volts between LAM 4850A and SUT are compensated for. |

Table 1-2. EQUIPMENT, ACCESSORIES, AND DOCUMENTS SUPPLIED

| QNTY | MODEL NO. | NAME | DESCRIPTION |
|---|---|---|---|
| 1 | LAM 4850A | 48 Channel Logic Analyzer System | Logic Analyzer upgradable to a variety of advanced hardware and software configurations. |
| 1 | GPIB/ IEEE 488 | General Purpose Interface Board | Allows remote control/-monitoring of LAM 4850A functions. (Parallel) |
| 1 | RS-232 | RS-232 Interface | Allows remote control/-monitoring of LAM 4850A functions. (Serial) |
| 1 | 3 4851-01/B | LAM 4850A Operator's Manual | Volume I, which describes operation of the LAM 4850A |
| 1 | | Video Adapter | Allows for external video monitor connection. |
| 14 | ALP44 | Active Logic Probe | Used to adapt signals inputed to the LAM 4850A. (Changed to ECL Logic) |

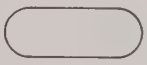
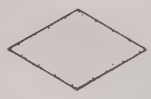
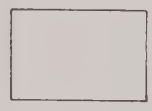
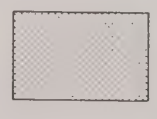
| Symbol | Meaning |
|---|---|
| | CRT Display or other Hardware |
| | Pushbutton or Panel Control |
|  | Start or End |
| | Operation (or user) Decision |
|  | Internal Logic Analyzer Decision |
|  | Process |
|  | Internal Logic Analyzer Process |
| | Off-Page Connector |
| | On-Page Connector |

Table 1-4. Symbols

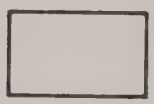
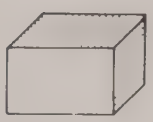
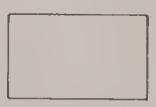
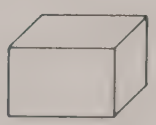
| Symbol | Meaning |
|---|---|
| | Major Functional or Signal Flow |
| | Secondary Functional or Signal Flow |
| | Connection or Multiplication of Function or Signal |
| | Major Data or Function Transfer |
| | Key to Text or Note |
| | Signal or Function Flow Name |
|  <br> | Major Function (Level 1)<br>(Sometimes may be Shaded) |
| <br>  | PCB or other Hardware (Level 2) |
|  <br>  | Subfunction (Level 2 or 3) |

Table 1-4. Symbols

Table 1-3. CODES AND ABBREVIATIONS

| Abbreviation | Meaning |
|---|---|
| ALP | Active Logic Probe |
| BIN | Binary |
| CLK | Clock |
| CRT | Cathode Ray Tube |
| CUR or "C" | Cursor |
| DAC | Digital-To-Analog Converter |
| DEC | Decrement |
| ECL | Emitter-Coupled-Logic |
| ENT | Enter |
| GPIB | General Purpose Interface Bus |
| HEX | Hexadecimal |
| INC | Increment |
| INT | Internal |
| KBD | Keyboard |
| LAM | Logic Analyzer Monitor |
| LAT | Latch (Mode) |
| NEG | Negative |
| OCT | Octal |
| PB | Pushbutton |
| PCB | Printed Circuit Board |
| POS | Positive |
| REF or "R" | Reference (Memory) |
| RS - 232 | Serial Interface |
| S | Set Point |
| SAM | Sample (Mode) |
| SBLA | Single Board Logic Analyzer |

Table 1-3. CODES AND ABBREVIATIONS (continued)

| Abbreviation | Meaning |
|---|---|
| SEQ | Sequence |
| SRC or "S" | Source (Memory) |
| SRCH | Search |
| STP | Stop |
| SUT | System Under Test |
| TTL | Transistor-To-Transistor Logic |
| TRG or "T" | Trigger Point |
| V1 | Variable Voltage 1 |
| V2 | Variable Voltage 2 |

# SECTION 2

# UNPACKING AND INSTALLATION

## 2.1 GENERAL

Information required for unpacking and preparation for use is contained in the following section. Reshipping instructions are included in case the device must be returned for calibration or repair.

## 2.2 UNPACKING

Refer to Figure 2-1 for an illustration of the unpacking sequence. Open the LAM 4850A packaging carefully. The LAM 4850A is packaged in a plastic covered, form-fitting foam. Remove the equipment and verify that the shipment is complete according to the shipping list. You should find an operating manual and power cord.

Perform the following visual inspection to determine that no damage has occurred during shipment:

- Check for loose or missing screws, controls, etc.
- Check connectors for damaged pins.
- Check that controls operate freely and that all labels are legible.
- Check for visible damage eg. chipped or broken controls, scratches, dents to case.

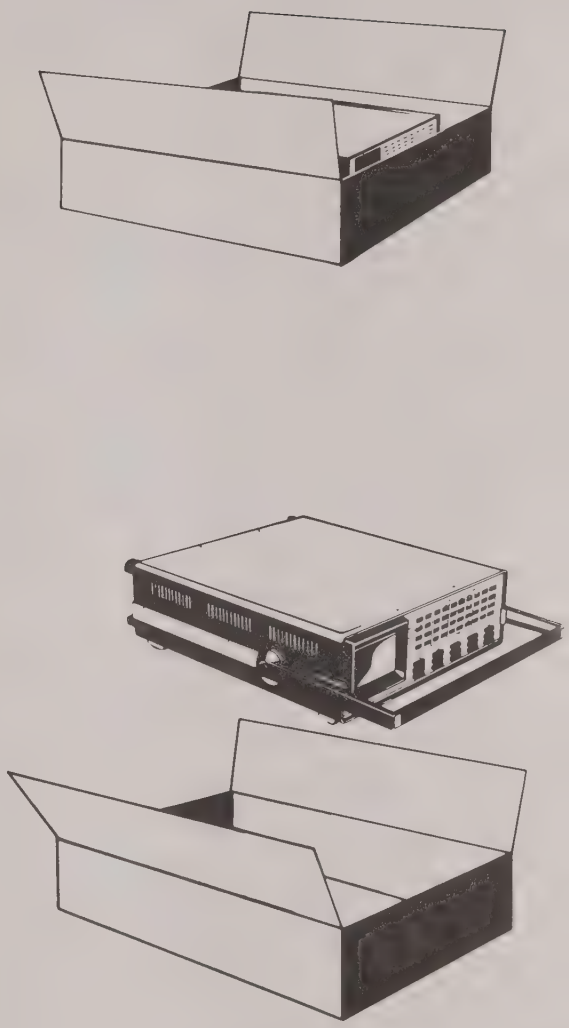


FIGURE 2-1. UNPACKING SEQUENCE

## 2.3 WARRANTY INFORMATION

If the instrument is damaged in any way or does not operate in accordance with the operation instructions notify the Dolch distributor or the Dolch service department immediately. In case of physical damage, the shipping agent should also be notified. The Dolch warranty conditions are given in the back of the manual.

Retain packaging material and shipping carton for inspection if the instrument is damaged.

## 2.4 PRE-POWER PROCEDURES

The LAM 4850A features self-test capabilities that allow for easy installation and power-up procedures. The following section provides details for these procedures.

### 2.4.1 Installation

Refer to Figure 2-2 for recommended installation steps. When the LAM 4850A is unpacked it may be placed in a standard test bench set-up by pressing both large buttons on the side of the case to release the handle. Release both buttons to lock the handle into place as a stand.

Install the Power Cord supplied. Refer to specific option documentation for details on other special configurations and their installation, as well as additional connections to the rear panel as necessary.

**2.4.1.1 Rack Mounting.** The LAM 4850A may be configured for standard rack mounting. Refer to the Rack Mount Kit for installation procedures.

### 2.4.2 Power Requirements

The LAM 4850A operates on 110 or 220 VAC. Check the silkscreen nomenclature under the power connector for the proper voltage to be supplied. Also see Table 1-1.

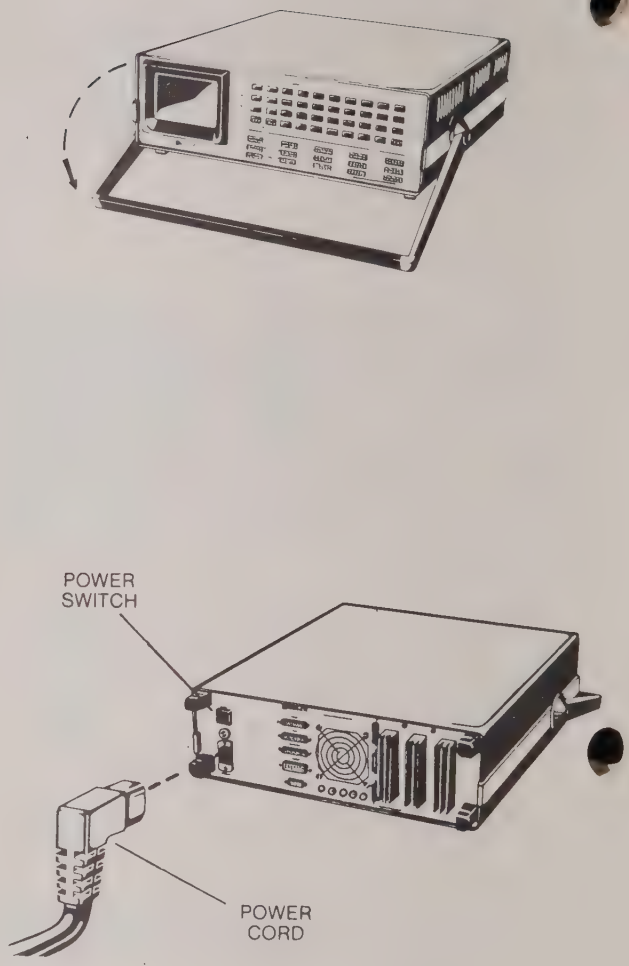


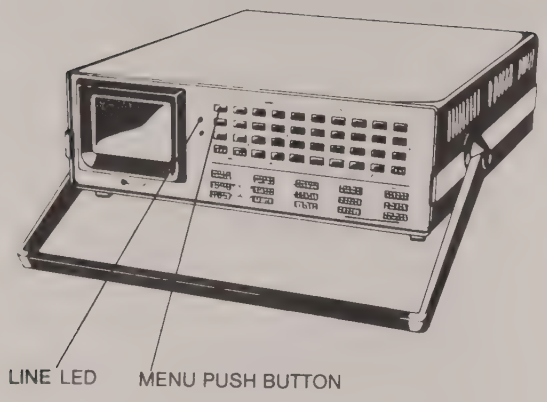

FIGURE 2-2. INSTALLATION STEPS

## 2.5 INITIAL TURN-ON/ CHECK-OUT PROCEDURES

Verify that all pre-power procedures have been done. See Figure 2-3 and proceed as follows:

1) Set the POWER switch to ON. Verify that the "LINE" LED on the Front panel is LIT. The LAM 4850A will show random blinking symbols for a few seconds.

2) Verify that the "POWER UP SELF TEST COMPLETE!" display is present on the CRT after approx. 15-30 seconds, depending on the options installed. If the "NON VOLATILE



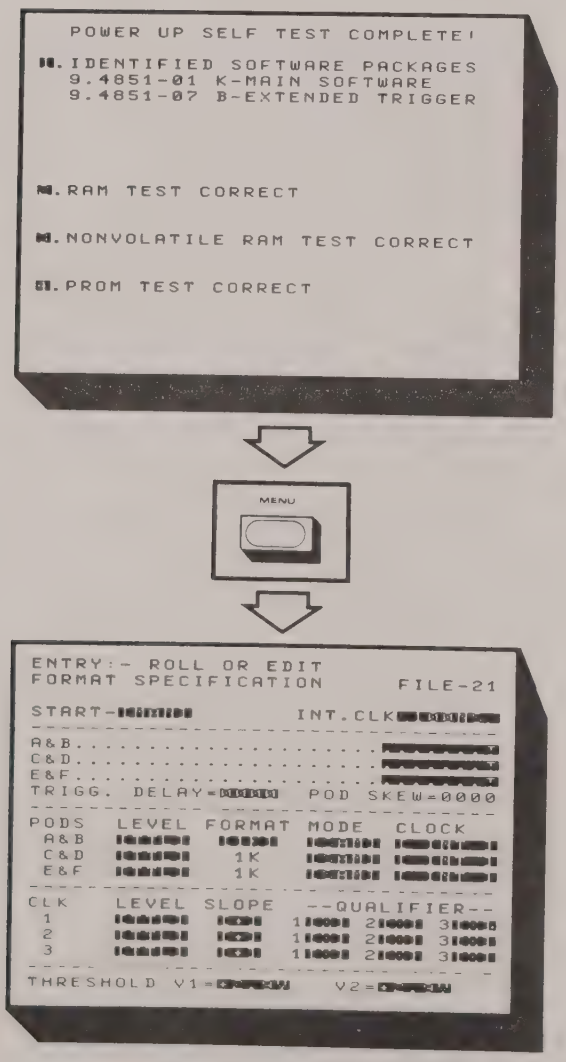




FIGURE 2-3. TURN-ON

RAM TEST FAILED" message is received it may be ignored. This message simply indicates that there are no Set-ups in the "SCRATCH FILE" memory. This will not effect normal operation of the analyzer.

3) The "POWER UP SELF TEST COMPLETE!" message consists of the following parts:

A) Part 1 - Lists software packages and/or options that have been installed in the device.

B) Part 2 - Shows the result of internal RAM test. A defect will be shown as a "1" in inverse video, indicating the RAM cell affected. If this message is shown, refer to the Service Manual for details.

C) Part 3 - Displays information about the SCRATCH TABLE contents. It will indicate the first memory that does not contain correct data.

D) Part 4 - Shows the result of internal PROM test. A defect will be shown as a number in inverse video, indicating the PROM location affected. If this message is shown, refer to the Service Manual for details.

4) Make a note of any power-up problems. Press and release the "MENU" pushbutton. The "POWER UP" message is cancelled from the CRT. Verify that the TRACE MENU (FORMAT SPECIFICATION) is displayed.

If any of the above procedures fails to result in a successful Turn-On, try them again. If the analyzer is still unable to operate call the factory for assistance.

## 2.6 TURN-OFF PROCEDURE

Nothing fancy! Just turn the power switch OFF. However, you may want to save your set-ups so see section 5.6 for details.

## 2.7 REPACKING FOR SHIPMENT

If reshipment is required, the device should be repacked in the original packaging. If this is not available, pack the device using sufficient packing and a solid cardboard or wooden box. If repacking for device repair is necessary, inform your local representative. Enclose a note with the device describing the malfunction, damage etc. with the name and address of company and person responsible.

Shipment should be made to DOLCH service department or supplier as listed on back cover of this manual.

# SECTION 3

## FUNCTIONAL DESCRIPTION/ THEORY OF OPERATION

### 3.1 GENERAL

This section is divided into two parts: the first provides a functional description of hardware elements, and the second provides the theory of operation of the LAM 4850A. Figure 3-1 shows a top view of a LAM 4850A with the cover removed. Figure 3-2 shows an overall hardware function diagram, with keys to text. Figure 3-3 shows the overall operating sequence of the LAM 4850A. Figures 3-1, 3-2 and 3-3 are located in the back of this section on large size fold-outs.

### 3.2 OVERALL HARDWARE FUNCTION DIAGRAM

Refer to Figure 3-2 for details in the following discussion. Circle numbers are annotated to correspond to each subtitle in this section.

#### 3.2.1 Input Function

The Input Function is shown in ① . This represents the first stage of operation. Incoming data is digitized and conditioned to ECL logic through the ALP 44 devices, which then pass the data to the Input PCB's. ALP 44 connection to the Input PCB's is through the front panel connectors labelled as follows:

| Pods | Input |
|---|---|
| A | 3-0, 7-4 |
| B | 3-0, 7-4 |
| C | 3-0, 7-4 |
| D | 3-0, 7-4 |
| E | 3-0, 7-4 |
| F | 3-0, 7-4 |

The standard Input PCB contains line receivers and for channel group A + B only, additional glitch capturing circuitry.

#### 3.2.2 Clocking Function

The Clocking Function is shown in ② . It is comprised of the Timebase PCB and Clock/Qualifier . ALP 44s. Three external clocks and qualifiers and an internal sample clock (20 ns to 500 ms) can be assigned to all recording blocks. The selected clock edge latches the digitized information on the appropriate Input PCB with every active edge. The Timebase PCB provides the clocking function with two types of output: Internal clock or external clock with qualifiers.

**3.2.2.1 Clocks.** The Internal Clock is used for internal sampling. Note that the maximum sample rate in the 1K Format (48 bit word) is 20 MHz (50 ns). In the 2K Format (32 bit word) there are two sampling rates: 1) Pods A + B are combined with C + D and Pods E + F are turned OFF (Interlace mode, 16 x 2000 bits) or clocked internally; in which case the maximum sample rate is 30 MHz (50 ns). 2) Pods A + B are combined with C + D and Pods E + F are turned OFF or clocked externally (Interlace mode 16 x 2000 bits); in which case the maximum sample rate is 50 MHz (20 ns). Note that the maximum sampling rate using External Clocks, either in 1K Format (48 bit words) or 2K (32 bit words) is 25 MHz.

**3.2.2.2. Qualifiers.** Three external clocks and qualifiers may be assigned as desired. The maximum external clock rate specified for 1K or 2K Formats is 25 MHz. This allows for different external clocks that may be completely out of phase and asynchronous. Note that problems may occur between the LAM 4850A and the SUT if clock or qualified frequencies are higher than specified.

**3.2.2.3 Clock and Qualifiers ALP 44s.** These ALP's are electrically identical to the data ALP's. The only difference between data, clock, and qualifier ALP 44s is in the labelling on the connectors.

### 3.2.3 Memory Block

The Memory Block is shown in ③. This function is provided by the SBLA's, one for each memory PCB. The input PCB outputs are stored in the appropriate SBLA, which contains some control logic, 16 x 1K memory, and Trigger word recognizers. The SBLA memory is filled with data from the input PCB depending on the status of an additional qualification control line (see clocking function ②). In the standard version this line is held in a particular state so that every event will be stored, but optionally the line may be used for sophisticated data qualification.

**3.2.3.1 Memory Formatting.** The three recording blocks (SBLA's) may be formatted in the following ways:

- 1K Format - where the three blocks are in parallel, each 1K deep with 16 bit words.

- 2K Format - where blocks A + B and C + D are combined, and E + F are also in "sampling" mode, SAM, with 16 bit words.

- 2K Format - when blocks A + B and C + D are combined, and E + F are turned OFF (32 bit word).

In the 2K Format, input data available to SBLA A + C are also switched to SBLA B + D. This switching occurs in an alternating fashion (interlace technique). Therefore, from the user's point of view the memory depth of recording block A + C will be doubled. B + D is no longer available. Recording block E + F can be shifted relative to the pod-skew parameter defined in the TRACE MENU. See the Operating Procedures section of this manual for details.

**3.2.3.2 Reference Memory.** For each SBLA PCB exists a Reference Memory equal in size to the recording block. Both memories can be compared automatically in the Compare Mode.

This is possible only if both memories are equally formatted (same number of blocks used, same recording mode, same pod-skew). The Reference Memory is formatted automatically when the Source Memory is copied to the Reference Memory.

### 3.2.4 Triggering/Trace Control Function

The Triggering/Trace Control Function is shown in ④. It is comprised of the Control PCB (not shown) and the Trigger PCB.

The Control PCB is used to generate common signals for controlling the complete trace sequence of the Logic Analyzer, (trigger delay, pod-skew, inter lace). This board is flexible in the sense that any further modification of the SBLA's memory depth, trigger and data qualify capabilities will not influence its operation.

The Trigger PCB receives the outputs of all Trigger word recognizers, and /or data-qualification word recognizers, from the SBLA's inputs. It then combines them to perform all sequential trigger functions.

### 3.2.5 Microprocessor Control Function

Control over all LAM 4850A functions is exercised by a Z80 type microprocessor. This function, ⑤, is provided by the CPU PCB, where the Z80 resides, and the associated memory PCB's ① and ②.

The Microprocessor Control Function controls the internal communication bus as well as LAM 4850A interface to outside devices.

### 3.2.6 Operator Input Function

The normal input of system control and parameter manipulation is by the front panel keyboard. This is shown in ⑥. All front panel pushbuttons are connected to the keyboard PCB, which is situated immediately behind the front panel plate.

### 3.2.7 Display Function

The Display Function is shown in ⑦. It consists of the CRT, which is the primary monitor for all LAM 4850A and operator interaction. The Character Generator PCB and Raster Counter PCB are associated with the actual CRT.

### 3.2.8 Remote Control Function

The Remote Control Function is shown in ⑧. The Threshold/GPIB PCB includes circuits for setting variable input data and qualifier voltages, as well as the General Purpose Interface Bus (GPIB). See appendix A of this manual for details of GPIB operation.

The GPIB interface allows the user to control most functions of the LAM 4850A remotely with the IEC bus. Furthermore, it enables the transfer of data recordings to other GPIB compatible devices. There are, thus, several types of remote control interfaces possible at any one time:

- GPIB/IEEE 488
- RS 232/V24 (without modem control lines
- Optional (full RS 232C with modem control)

### 3.2.9 Optional Function

The Optional Function is shown in ⑨. Options installed may be accessed by using the "Option" pushbutton. There may be five software options available. However, some options require additional hardware support. A firmware module must be installed for these options. The microprocessor detects these automatically and shows their presence in a directory after power up. This slot in the card cage is reserved for further hardware expansions.

### 3.2.10 Internal Communication Bus

All LAM 4850A PCB's are connected to the microprocessor system (Z80) by a standardized internal communication bus, ⑩. Every board can be changed, modified, replaced, or added without affecting the system architecture. This capability forms the basis for future options.

## 3.3 OVERALL OPERATING SEQUENCE

Refer to Figure 3-3 for details in the following discussion. Each part of the overall operating sequence of the 4850A is referred to in the following sections.

The LAM 4850A operates in four basic modes:

- Pre-Record Programming
- Data Recording
- Data Analysis
- File Manipulation

The LAM 4850A can be considered as a shift register into which data is clocked continuously until a trigger event stops the recording. All parameters necessary to control the actual recording are inputed to the LAM 4850A during the Pre-Record Programming Mode of operation. See paragraph 5.3.

During the Data Recording Mode, the Logic Analyzer samples all data until it finds the preprogrammed trigger conditions to initiate a stop of the recording. See paragraph 5.4.

During the Data Analysis Mode, the Logic Analyzer can be ordered to recall previously recorded data in a variety of manners and formats. In this mode functions allow for searching through the data and for controlling the memory contents itself. See paragraph 5.5.

The File Manipulation Mode allows the operator to store and recall various test set-ups for future use. See paragraph 5.6.

### 3.3.1 Pre-Record Programming Mode

This mode of operation is best thought of as the time when the user tells the LAM 4850A the following:

- What to do
- How to do it
- When to do it

One important note to be made is that the use of the word "Trigger" has a somewhat different meaning than normal, especially to those who are accustomed to oscilloscope operation. The "Trigger" word is a particular piece of digital data you tell the logic analyzer to look for. The analyzer then begins to record incoming data (you tell it when and how to record). When it recognizes the "Trigger" word, it will cease recording after a pre-selected time delay.

Control over the sequence and type of recording to be done is provided by the following functions:

- Trace (Format Spec)
- Trigger (Trigger Sequence)
- Compare
- Set-Up Monitor
- Option(s)

**3.3.1.1 Trace Function.** The TRACE MENU provides control over the Trace Function. This function allows the user to select when the recording will be made, which memory format to use, how much data will be recorded before and after the trigger word is recognized, what pods will be used as data inputs, what type of sampling will be done by the various memory blocks, and what kind of clocks will be used.

**3.3.1.2 Trigger Function.** The Trigger Function allows the user to program the Trigger Word(s) to look for and how to look for them. This is done with the TRIGGER MENU and the TRIGGER WORD DEFINITON pages (1 + 2).

The TRIGGER MENU allows for extremely complex sequences of events to be programmed through many levels. The organization is as follows:

- 12 levels
- 4 sequences
- 3 levels inside the sequence

Using the TRIGGER MENU, the operator can program branches, jumps, loops, and conditional operation.

The TRIGGER WORD DEFINITION PAGES allow the user to program up to 12 words for Trigger or Trace. In addition, each word may be up to 48 bits long.

**3.3.1.3 Compare Function.** The Compare Function allows the LAM 4850A to "compare" information previously recorded into "reference" memory with a new recording of data. This function is particularly useful when one wishes to check the performance of the SUT against itself or a reference. The COMPARE MENU provides the control over this function.

With the COMPARE MENU it is possible to select the beginning and ending addresses, skew range, compare mode, and compare conditions for test. The menu provides a running count of cycles and the times the preprogrammed conditions have occurred.

**3.3.1.4 Set-Up Monitor Function.** While programming parameters of the LAM 4850A, the user may call the Set-Up Function by pressing the "MONITOR" pushbutton. The Analyzer will respond with one of two types of messages on the Set-Up Monitor Display. The first type of display indicates a "Valid Set-Up". This message shows a summary of programmed parameters. The second type of message is one that displays "Set-Up Results" to indicate that there is an invalid or wrong combination of parameters programmed. This type of message will appear when an incorrectly programmed recording is attempted.

The Set-Up Monitor can only monitor programmable parameters relating to the internal structure of the LAM 4850A. It cannot monitor set-up conditions external to the analyzer.

Note that the COMPARE MENU also features a separate Set-up Monitor.

**3.3.1.5 Option Function.** Some options that are installed in the LAM 4850A may be called for use in the Pre-Record Programming mode. The Option Table is displayed when the "OPTION" pushbutton is pressed. The user may then select the option desired. See paragraph 5.3.6. of this manual for details.

### 3.3.2 Data Recording Mode

Once the user has programmed the Pre-Record parameters, and has started the recording process, the analyzer steps through the three phases which are typical for each data recording. These phases are as follows:

- Pretrigger Sampling
- Trigger Trace
- Trigger Delay

The Pretrigger Sampling phase is a process whereby the analyzer readies itself to recognize the trigger word(s) programmed. This phase ensures that with a new recording the analyzer is completely filled with actual data. Every recording block must get enough clocks (memory depth minus trigger delay time) before it can accept a trigger word. When this phase is done, the analyzer is ready for the Trigger Trace phase.

The Trigger Trace phase is active when the analyzer steps from sequence to sequence, searching for the programmed trigger word(s) conditions. Each recording block searches for the trigger word at its input with the assigned recording clock. Since these clocks can differ in frequency and phase, the trigger events coming from each SBLA's word recognizer must be synchronized with a trigger word sample clock, as programmed. The sequential search is programmed in the TRIGGER MENU (Pre-Record Programming Mode), which can cause the sequence to either jump to the next level or restart the search from the beginning.

The Trigger Delay phase begins once the trigger word conditions have been met. When the trigger is found, each SBLA must sample post-trigger data according to the programmed trigger delay. This delay is counted in clocks, which were selected previously for recording. Thus, each SBLA can stop recording independently of other recording blocks.

**3.3.2.1 Trace Monitor Function.** During a recording, the trace activity of the analyzer may be displayed by pressing the "MONITOR" pushbutton. The activity, through all phases of recording, is presented in a bar graph manner. When the graph "blinks" on any of the recording blocks, that phase (for that block) is active. The Trace Monitor is shown in the top portion of the display. See section 5.4.

**3.3.2.2 Trigger Monitor Function.** During a recording, the sequences of the TRIGGER MENU program may be displayed by pressing the "MONITOR" pushbutton. As each clock cycle or event is reached for the levels programmed, the counter is incremented. (Number of events, clock cycles, etc.). This display serves as a kind of running "score card" of the TRIGGER MENU program because it duplicates exactly the instructions as programmed in the TRIGGER MENU. This monitor is shown on the bottom part of the TRACE/TRIGGER Monitor. See Section 5.4.

### 3.3.3 Data Analysis Mode

Once a recording has been made, the user may begin to analyse the data recorded in a variety of manners as follows:

- Arrange data in a DATA LIST or TIMING DIAGRAM so that it is represented as clearly as possible. The user may do so by deleting channel groups, selecting different formats, etc.

- Allow the LAM 4850A to analyse data with automatic search functions. These include source reference comparisons, searching for a word in memory, or searching for a string of words, etc.

- Transferring the recorded data to the reference word in memory, or searching for a string of words, etc.

- Transferring the recorded data to the Reference Memory. When it is so stored it can be formatted for further comparisons as reference or for history only.

- Transmitting the data through the GPIB or a serial interface to an intelligent remote station.

The principle displays/functions used in the Data Analysis Mode of operation are the Timing Function and the List Function. The Memory and Search Functions are shared between them. In addition, options for each may also be called, as available.

**3.3.3.1 Timing Function.** The Timing Function is displayed with the TIMING DIAGRAM. This shows, in graphic form, the logical state (Binary) of each channel recorded. The user may make time measurements, add or delete channels to the display, rearrange channels displayed, and change other programmed parameters. In addition, powerful memory and search functions can be called to further enhance analysis capabilities.

**3.3.3.2 List Function.** The List Function is shown with the LIST DISPLAY. This shows, in tabular form, the memory locations, the logical state on each channel, and pod group assignments as programmed. As in the TIMING DIAGRAM, the user may utilize powerful search and memory functions. A useful feature of the List Function is that the user can go from the TIMING DIAGRAM to the LIST DISPLAY, alternatively, and find corresponding information.

### 3.3.4 File Manipulation Mode

The File Manipulation Mode is a "scratch" file function. The SCRATCH TABLE MENU is used to store and recall set-ups or menus.

**3.3.4.1 Scratch File.** The Scratch file is a battery backed C-MOS memory used to store or recall different set-ups and menus of the LAM 4850A. Information in this memory is held for up to 3 months without main power.

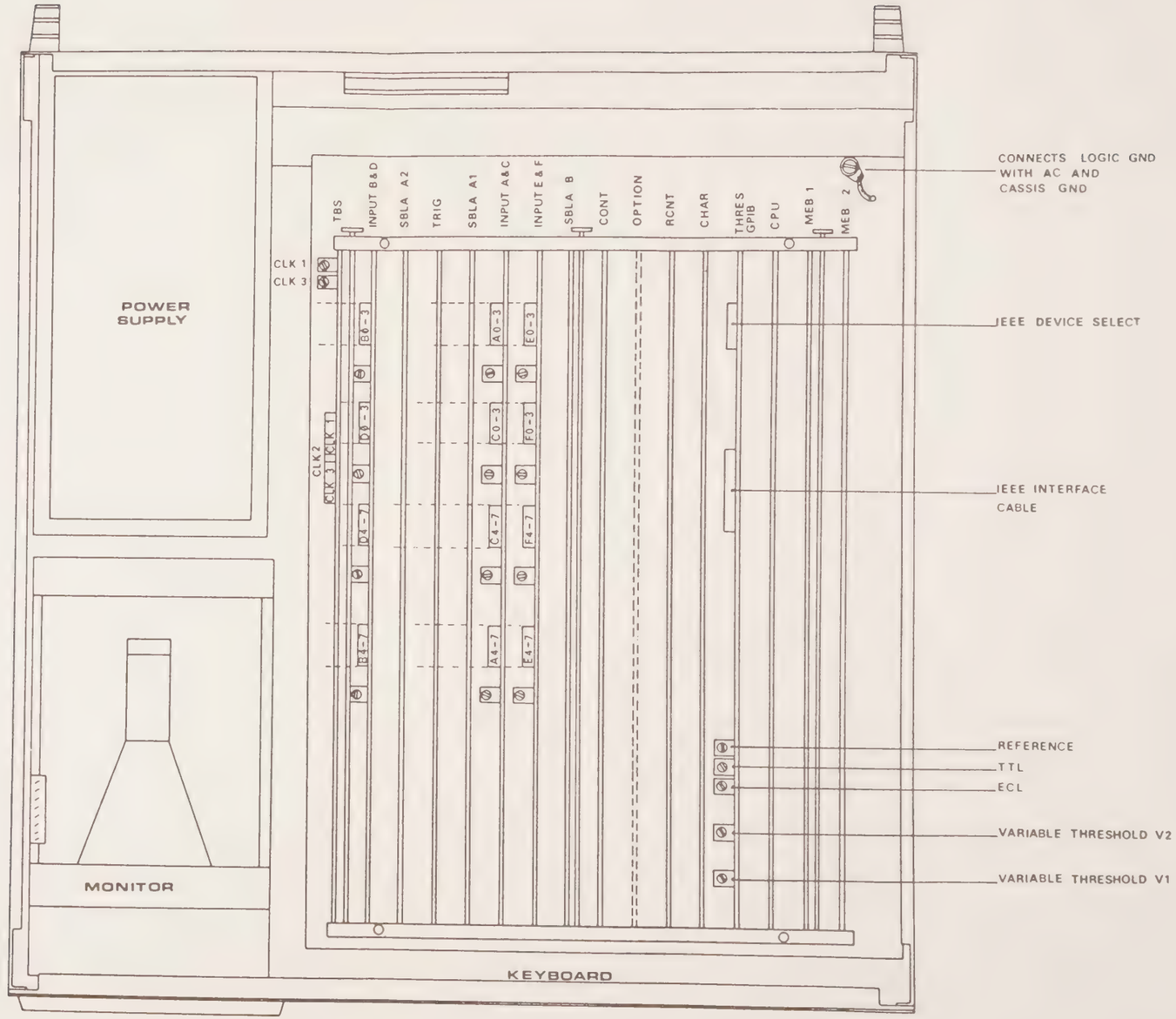



FIGURE 3-1. LAM 4850 A - TOP VIEW

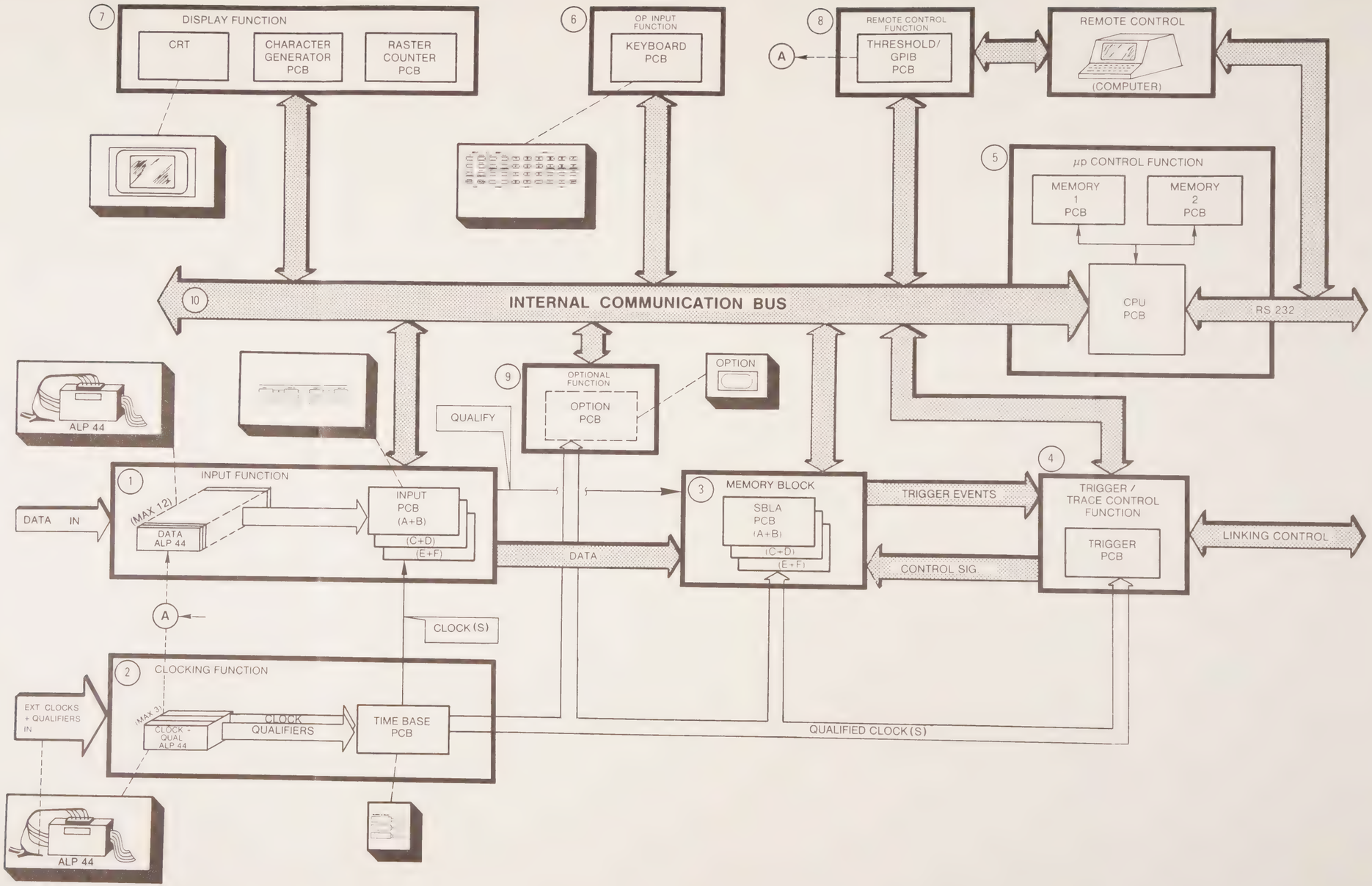



FIGURE 3-2. OVERALL HARDWARE FUNCTION DIAGRAM

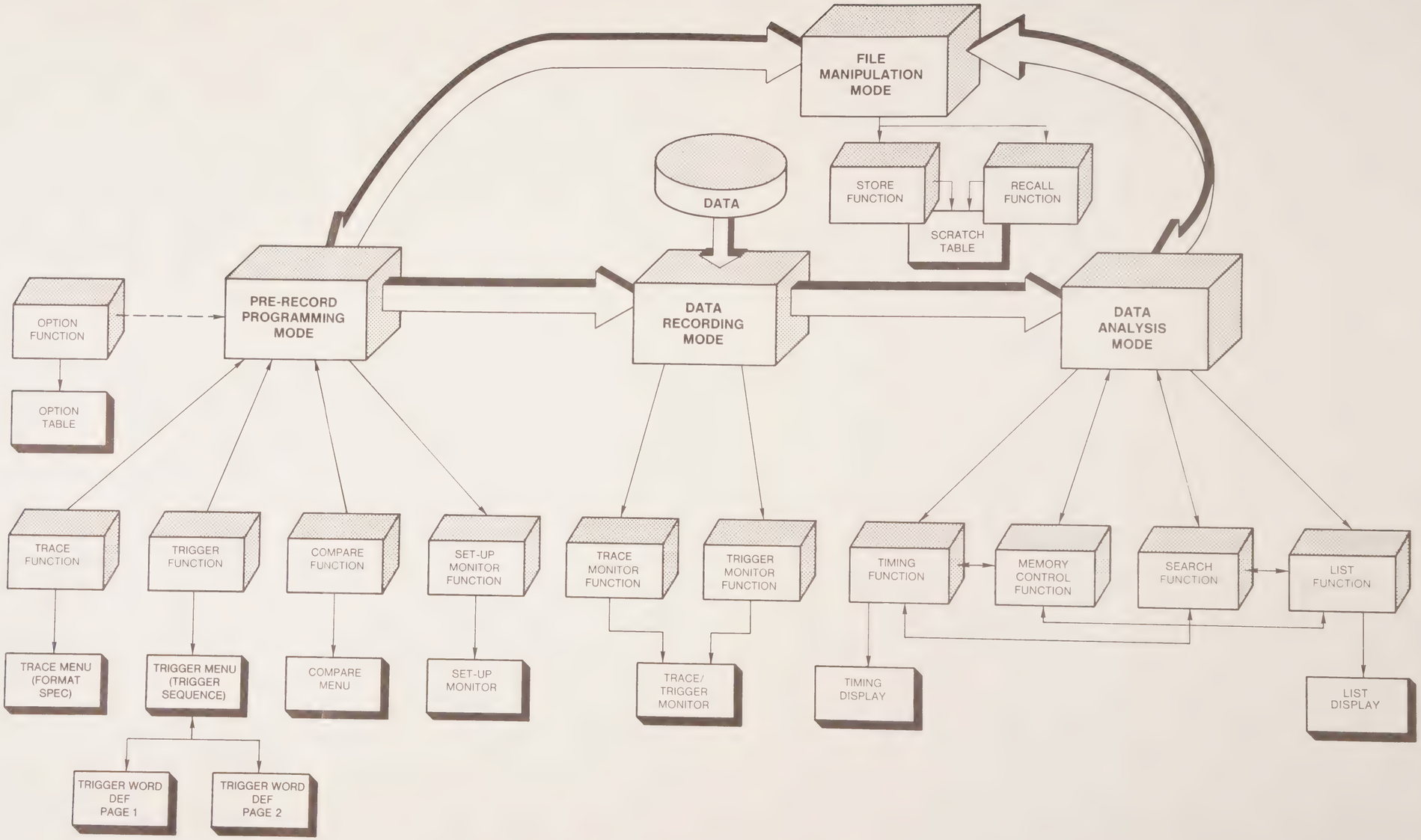



FIGURE 3-3. OVERALL OPERATING SEQUENCE

# SECTION 4

# CONTROLS AND DISPLAYS

# SECTION 4

# CONTROLS AND DISPLAYS

## 4.1 GENERAL

In this section, the location and function of all controls, indicators, displays, menus, and connectors are identified. In addition, the procedures necessary to gain access to the various menus and displays that control LAM 4850A operating parameter are given. Note that this portion of the manual does not provide details on theory or operation of the elements identified. See Section 5 for operating procedures.

## 4.2 CONTROLS

Refer to Figure 4-1 for an overall view of the LAM 4850A. The major elements of this device are backpanel controls, data aquisition connectors and devices, the keyboard, and the CRT. The CRT produces interactive menus, displays, and monitors.

### 4.2.1 Backpanel Controls

Figure 4-2 shows the location of all backpanel controls and connectors. Table 4-1 gives the function of each control with keys to Figure 4-2.

### 4.2.2 Data Acquisition Connectors

Figure 4-3 shows the Data Acquisition Connectors, which form the lower part of the front panel. The Data Aquisition Connectors are comprised of two parts: Data Input Pods, and External Clocks and Qualifiers Pods.

**4.2.2.1 Data Input Pods.** These are divided into 6 parts, labelled A, B, C, D, E, and F, respectively. Each pod is separated into two four-bit connector groups; the first of which is for data bits 0 through 3, and the second, which accomodates data bits 4 through 7.

**4.2.2.2 External Clocks And Qualifiers Pods.** There are three External Clocks and Qualifiers Pods, labelled 1, 2, and 3, respectively. Pod 1 may be used to assign an external clock to all input data pod groups. Other external Clocks (and qualifiers) can be inputed through Pod 2 and Pod 3.

**4.2.2.3 Other Input Devices.** Generally other devices such as serial-to-parallel probes, signature analyzers, serial interface probes, trace modules, and microprocessor personality probes are connected to the front panel of the LAM 64300 through ribbon connectors or other types of interfaces. Details on the controls, indicators, and operation of these devices are found in documentation shipped with them.

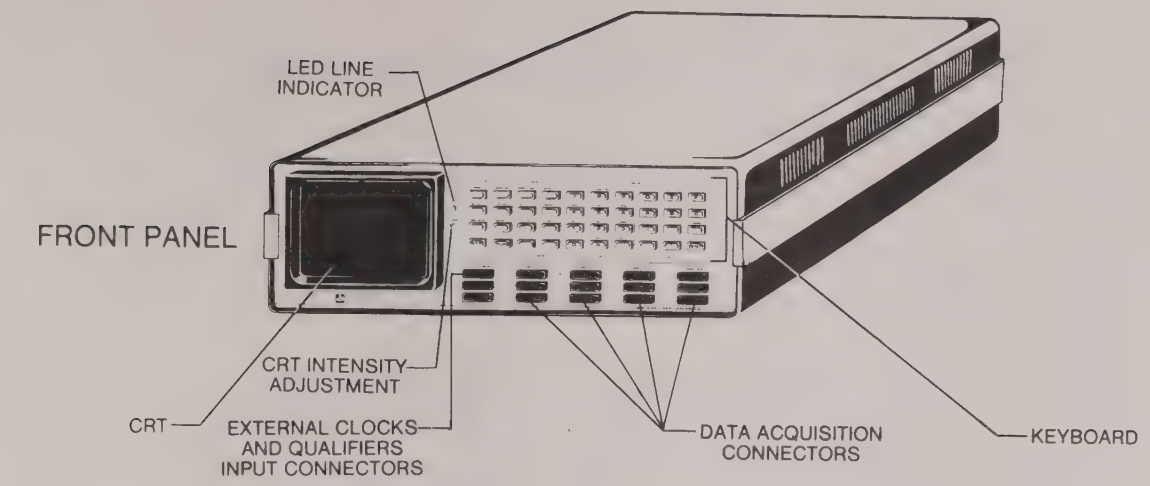
### 4.2.3 Keyboard

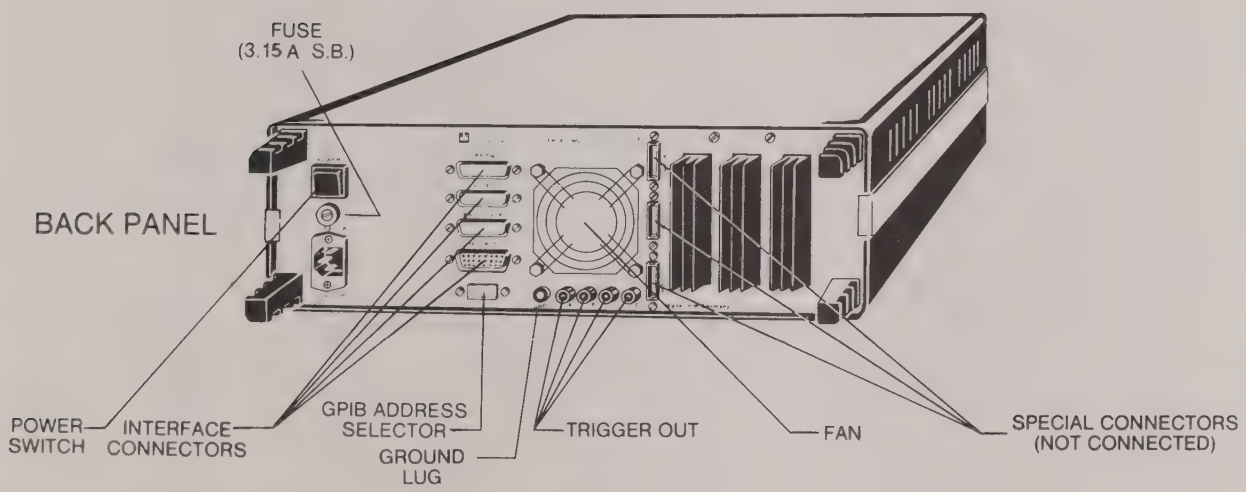
Figure 4-1 shows an illustration of the Keyboard. It is divided into the following parts (or groups):

- Display
- Trace
- Specify
- Cursor
- Entry
- Edit

Figure 4-4 shows the Keyboard Display, Trace, Specify, and Cursor Group pushbuttons. Table 4-2 describes the elements shown in Figure 4-4.

Figure 4-5 shows the Keyboard Entry and Edit Group pushbuttons. Table 4-3 describes the elements shown in Figure 4-5.



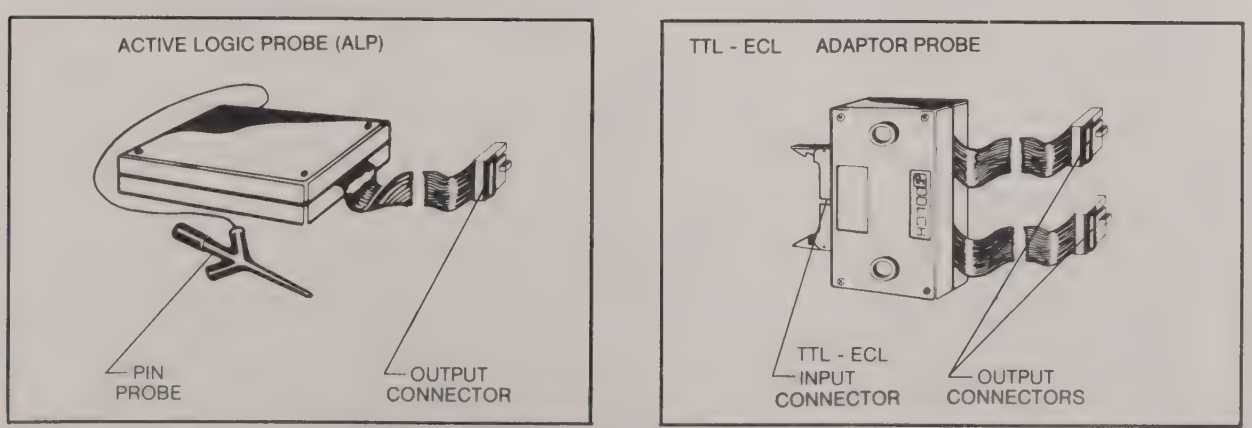




**FIGURE 4-1. CONTROLS AND INDICATORS, OVERALL VIEW**

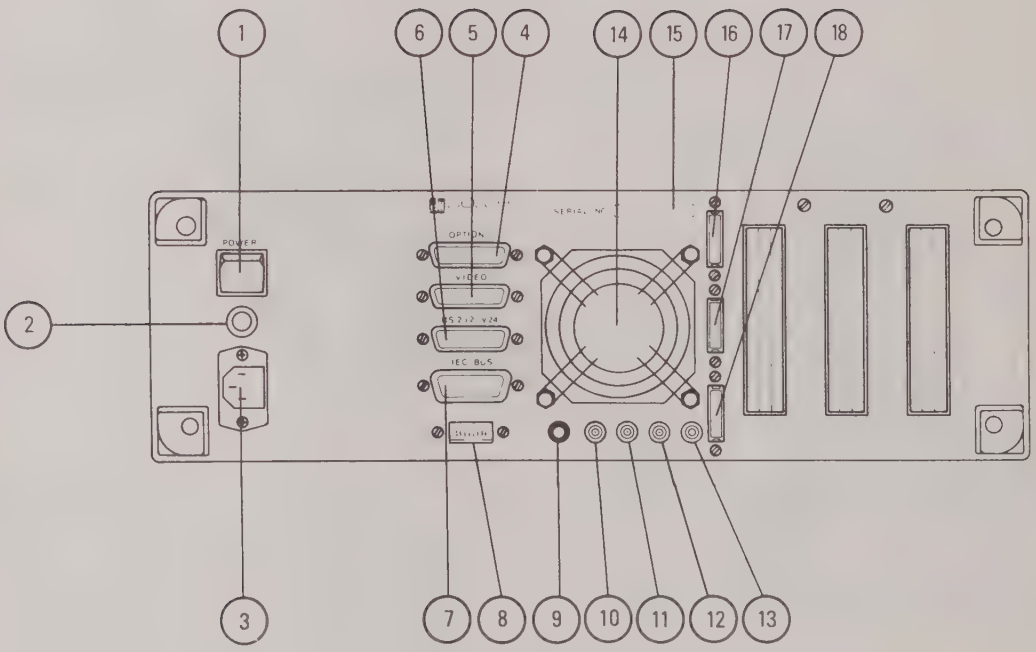



FIGURE 4-2. BACK PANEL CONTROLS AND CONNECTORS

TABLE 4-1. BACK PANEL CONTROLS AND CONNECTORS

| LOC COR | DESCRIPTION |
|---|---|
| 1 | Power Switch |
| 2 | Fuse |
| 3 | Power Socket |
| 4 | Option connector |
| 5 | External video interface connector |
| 6 | RS 232/V24 interface connector |
| 7 | IEC-Bus interface connector |
| 8 | Dual-In-Line switch for GPIB address selection |
| 9 | Ground lug |
| 10 | Trigger "A" - Trigger Output B |
| 11 | Trigger "B" - VH Composite Video (if installed) |
| 12 | Trigger "C" - Test Clock Output (or synch. input for Time Stamp Option) |
| 13 | Trigger "D" - RUN Output |
| 14 | Cooling fan |
| 15 | Serial number lable |
| 16 | Special interface connector (E1-4) N/C |
| 17 | Special interface connector (G3-0) N/C |
| 18 | Special interface connector (H3-0) N/C |

NOTES

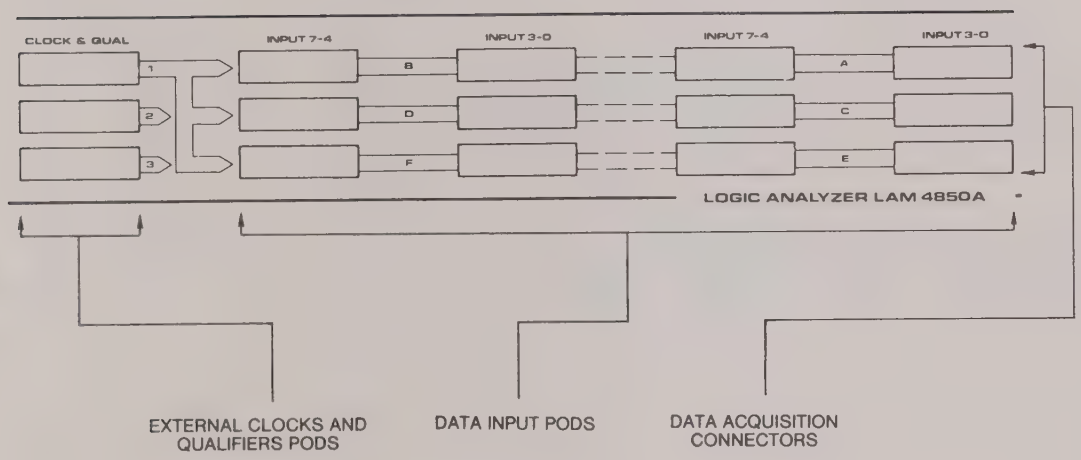



FIGURE 4-3. DATA/CLOCK CONNECTORS

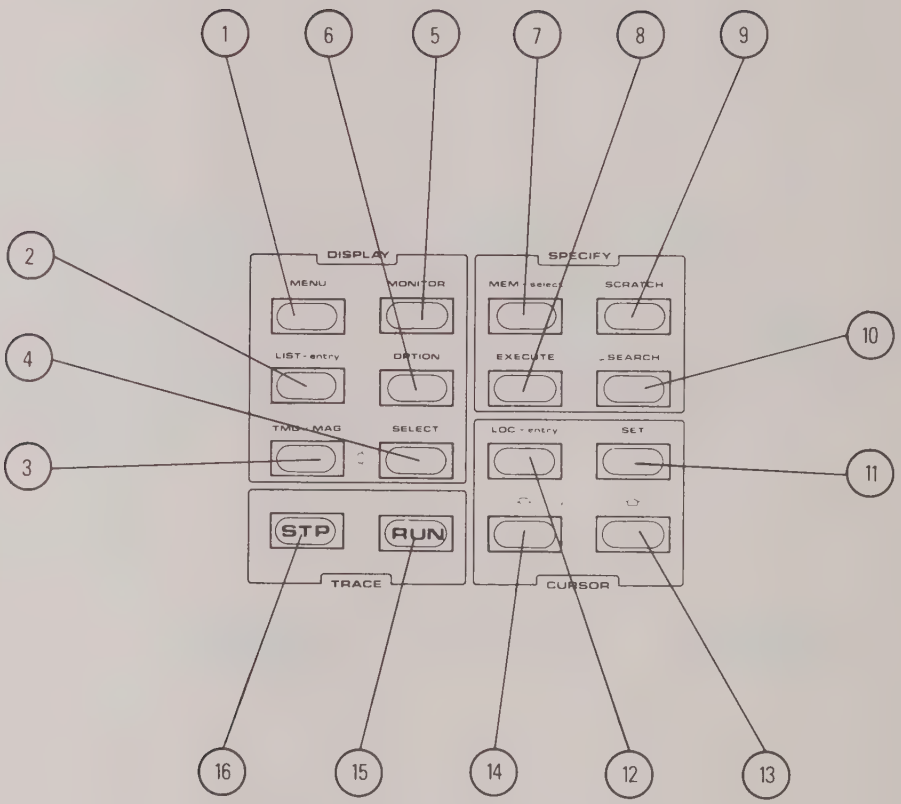



FIGURE 4-4. KEYBOARD DISPLAY, SPECIFY, CURSOR, AND TRACE GROUPS

TABLE 4-2. DISPLAY, SPECIFY, CURSOR, AND TRACE GROUPS

| LOC COR | NOMENCLATURE | DESCRIPTION |
|---|---|---|
| 1 | MENU | Selects display of the various menus available. May be pressed in single strokes or pressed and held for rapid scroll through menus. (Also see Section 4.3) |
| 2 | LIST-entry | Selects display of the DATA LIST. |
| 3 | TMG/MAG | 1st pressing shows a TIMING DIAGRAM of data memory in X1 expansion. In 1K Format 2nd pressing shows X 5 expansion. 3rd pressing shows X 10 expansion. For 2K Format expansion is X 10 and X 20 respectively. |
| 4 | SELECT | Selects pod group displays of the TIMING DIAGRAM. Repeated pressing scrolls the display through all chosen pod groups. Release the pushbutton to lock the desired group for display. |
| 5 | MONITOR | If pressed while in the Pre-Record Programming mode, will show the SET-UP MONITOR. When pressed during the Data Recording Mode, will display the TRACE/TRIGGER MONITOR. |
| 6 | OPTION | Activates a pre-selected option for display or function desired. |
| 7 | MEM-select | Selects different types of memory functions when the analyzer is in either TIMING or LIST displays. |
| 8 | EXECUTE | Used to initialize all functions selected in the SPECIFY GROUP of the Keyboard. |
| 9 | SCRATCH | Calls the SCRATCH TABLE menu for display. |
| 10 | SEARCH | Selects different types of search functions when the analyzer is in either TIMING or LIST displays. |
| 11 | SET | Used to "mark" the cursor position when the analyzer is in TIMING or LIST displays. |

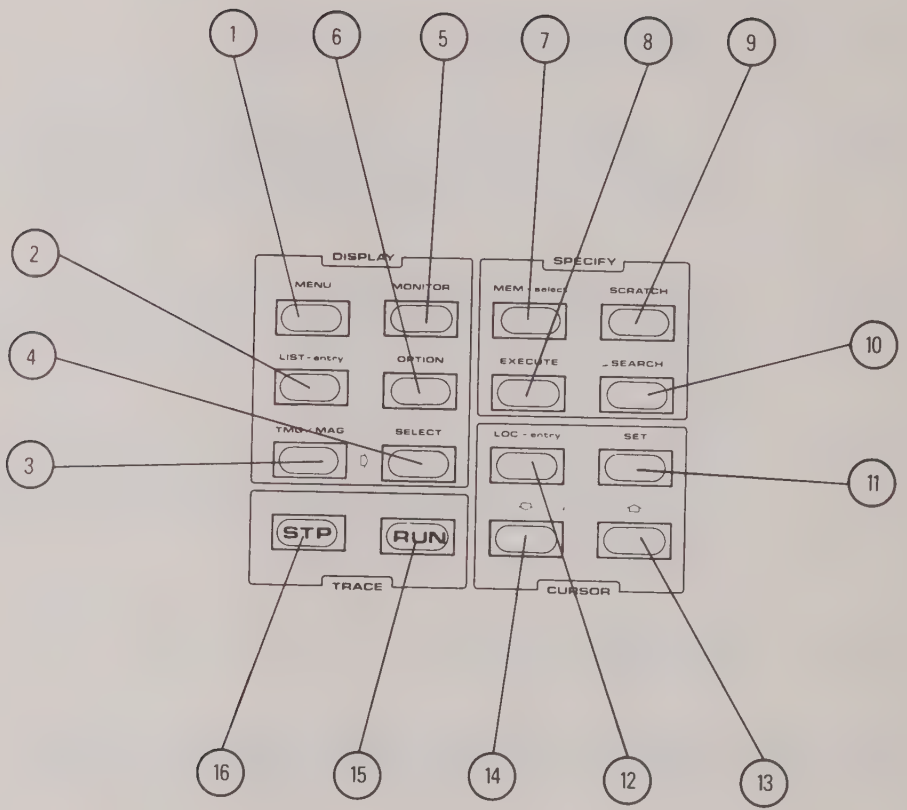



FIGURE 4-4 A. KEYBOARD DISPLAY, SPECIFY, CURSOR, AND TRACE GROUPS

TABLE 4-2. DISPLAY, SPECIFY, CURSOR, AND TRACE GROUPS (continued)

| LOC COR | NOMENCLATURE | DESCRIPTION |
|---|---|---|
| 12 | LOC-entry | Used to enter numerical values for cursor position in TIMING or LIST displays. |
| 13 | | Used to move the cursor "forward" in the TIMING display and "up" in the LIST display. |
| 14 | | Used to move the cursor "backwards" in the TIMING display and "down" in the LIST display. |
| 15 | RUN | Used to initialize data recording phase or comparison. |
| 16 | STP | Used to manually abort data recording or comparison. |

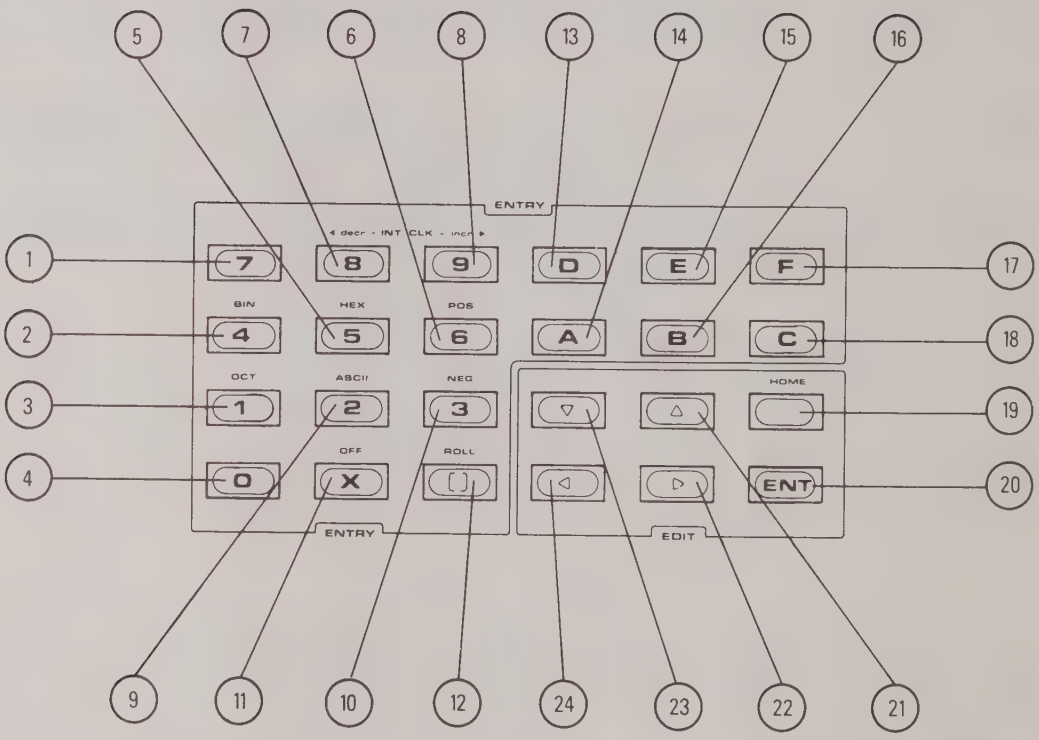



FIGURE 4-5. KEYBOARD ENTRY AND EDIT GROUPS

TABLE 4-3. ENTRY AND EDIT GROUPS

| LOC COR | NOMENCLATURE | DESCRIPTION |
|---|---|---|
| 1 | 7 | Used to input numerical value of seven when specified or desired. |
| 2 | 4 (BIN) | Used to input numerical value of four when specified or desired. Also used to assign Binary number base to selected pod groups when in LIST DISPLAY, TRIGGER WORD MENU, or SEQUENTIAL SEARCH MENU. |
| 3 | 1 (OCT) | Used to input numerical value of one when specified or desired. Also used to assign Octal number base to selected pod groups when in LIST DISPLAY, TRIGGER WORD MENU, or SEQUENTIAL SEARCH MENU. |
| 4 | 0 | Used to input numerical value of zero when specified or desired. |
| 5 | 5 (HEX) | Used to input numerical value of five when specified or desired. Also used to assign Hexadecimal number base to selected pod groups when in LIST DISPLAY, TRIGGER WORD MENU, or SEQUENTIAL SEARCH MENU. |
| 6 | 6 (POS) | Used to input numerical value of six when specified or desired. Also used to assign Positive polarity of data when in LIST display or TRIGGER WORD MENU, or SEQUENTIAL SEARCH MENU. |
| 7 | 8 (dec-INT CLK) | Used to input numerical value of eight when specified or desired. Also used to decrement internal clock rate value in a menu or display that is in use. Pushbutton may be pressed in single strokes or pressed and held for rapid scroll through values. |
| 8 | 9 (INT CLK-incr) | Used to input numerical value of nine when specified or desired. Operation is identical to "dec" pushbutton for incrementing internal clock rate values. |
| 9 | 2 (ASCII) | Used to input numerical value of two when specified or desired. Also used to assign ASCII display of data when in LIST DISPLAY. |

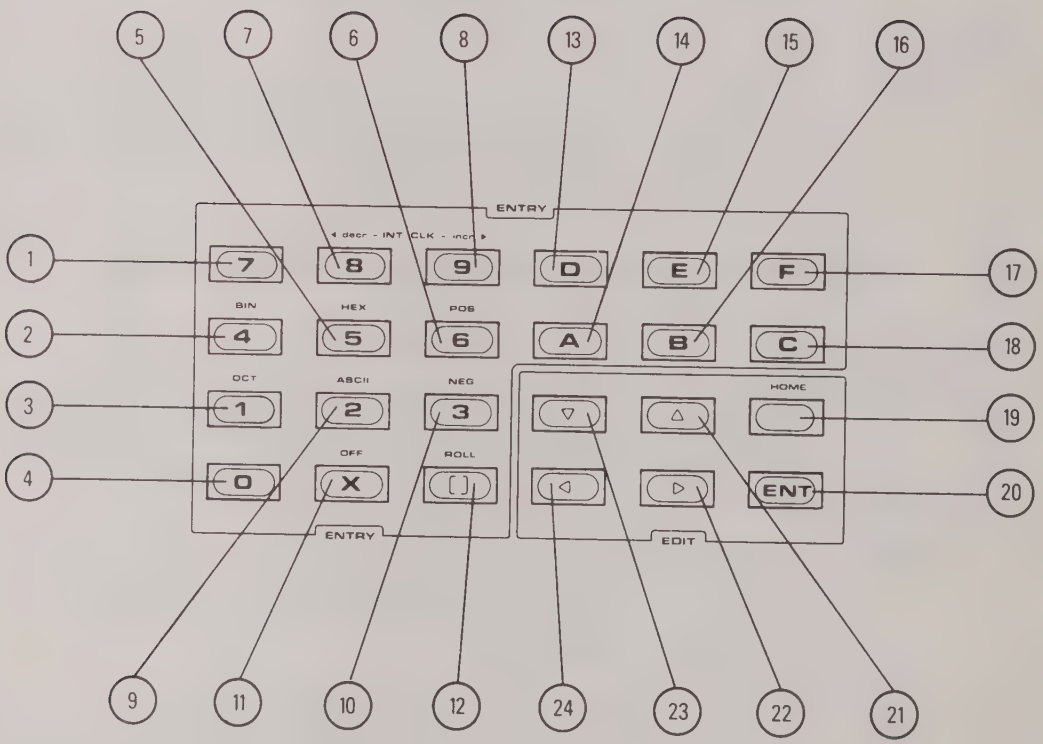



FIGURE 4-5 A. KEYBOARD ENTRY AND EDIT GROUPS

TABLE 4-3. ENTRY AND EDIT GROUPS (continued)

| LOC COR | NOMENCLATURE | DESCRIPTION |
|---|---|---|
| 10 | 3 (NEG) | Used to input numerical value of three when specified or desired. Also used to assign Negative polarity of data when in LIST DISPLAY, TRIGGER WORD MENU, or SEQUENTIAL SEARCH MENU. |
| 11 | X (OFF) | Used to select the "Don't Care" state when defining triggerword configurations in the TRIGGER WORD MENU. Also used to delete a pod group from the TIMING DIAGRAM, LIST DISPLAY, or SEQUENTIAL SEARCH MENU. |
| 12 | (ROLL) | Used to select functions available when the cursor is positioned at a "Bracket-Type Input" field of the set-up or menu desired. (See Section 5.2.1) |
| 13-18 | A, B, C, D, E, F | Used in various modes to select pod groups or to input Hexadecimal values when specified or desired. |
| 19 | HOME | Used to position the cursor back to the first programmable field in any menu or set-up. |
| 20 | ENTER | Must be pressed before and after values inputed for parameter fields of the "Non-Brackted type" in any menu or set-up. |
| 21-24 | | Cursor controls used to move the cursor to programmable fields during menu or set-up programming. |

## 4.3 MENUS

The LAM 4850A features five CRT displays called Menus. These are so called because the user may select parameters from their fields or may program parameters directly from the keyboard with interactive display. Figure 4-7 shows the menus in a group:

- Trace
  (Format Specification)
- Trigger
  (Trigger Sequence)
- Trigger Word Menu
- Compare
- Scratch Table
- Option(s)

Figure 4-6 illustrates the way to gain access to each of the displays. The list below indicates the Figure, and Table number describing it, for each menu in the following section.

| MENU | FIGURE | TABLE |
|---|---|---|
| TRACE | 4- 8 | 4-4 |
| TRIGGER | 4- 9 | 4-5 |
| TRIGGER WORD (DEFINITION) | 4-10 | 4-6 |
| COMPARE | 4-11 | 4-7 |
| SCRATCH | 4-12 | 4-8 |
| OPTION | 4-13 | - |

Note that each menu displays a prompt message at the top portion of the CRT to inform the user as to the menu name and the type of control available at the present cursor position.

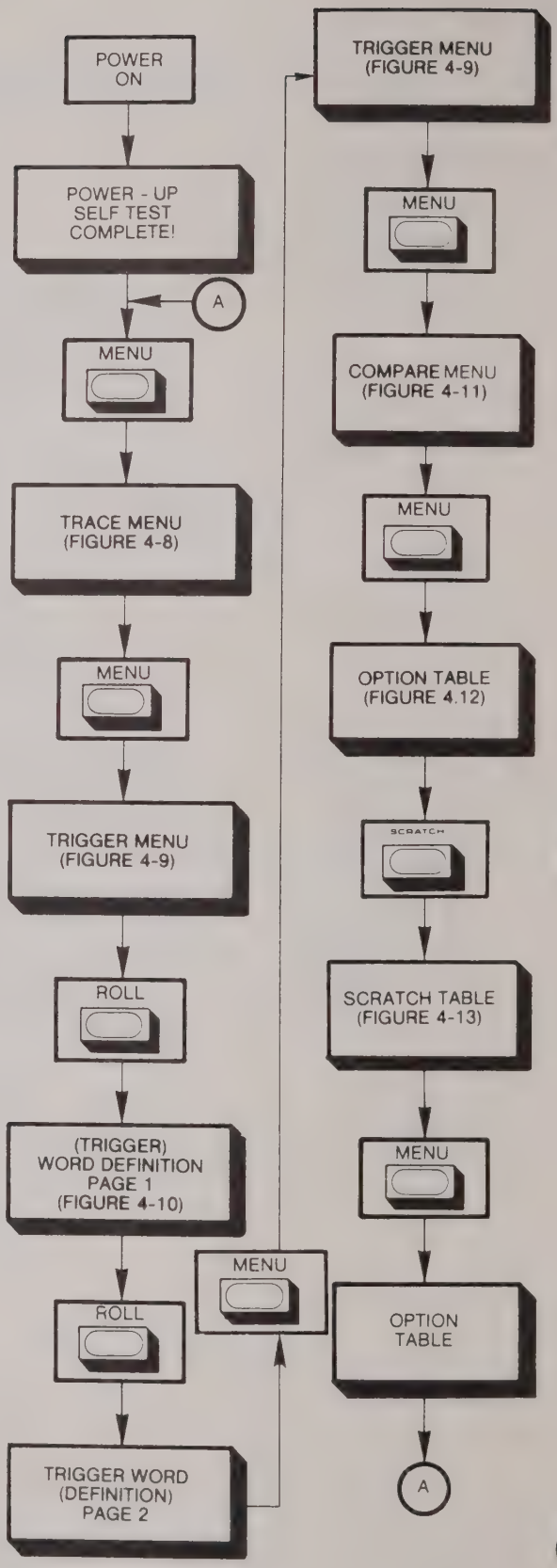
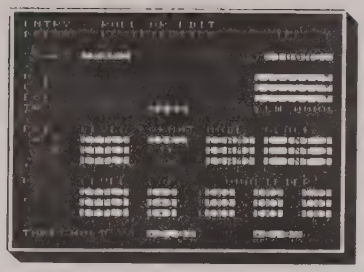
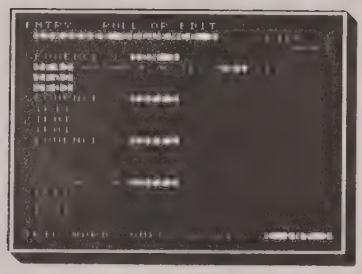


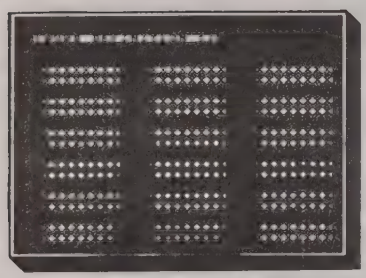

FIGURE 4-6. MENU ACCESS



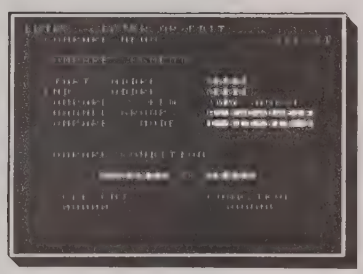
TRACE MENU
(FORMAT SPEC)



TRIGGER MENU
(TRIGGER SEQUENCE)

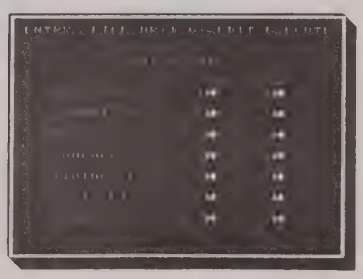


TRIGGER WORD
DEFINITION
PAGE



COMPARE
MENU

OPTION
TABLE



SCRATCH
TABLE

FIGURE 4-7. LAM 4850 A MENUS

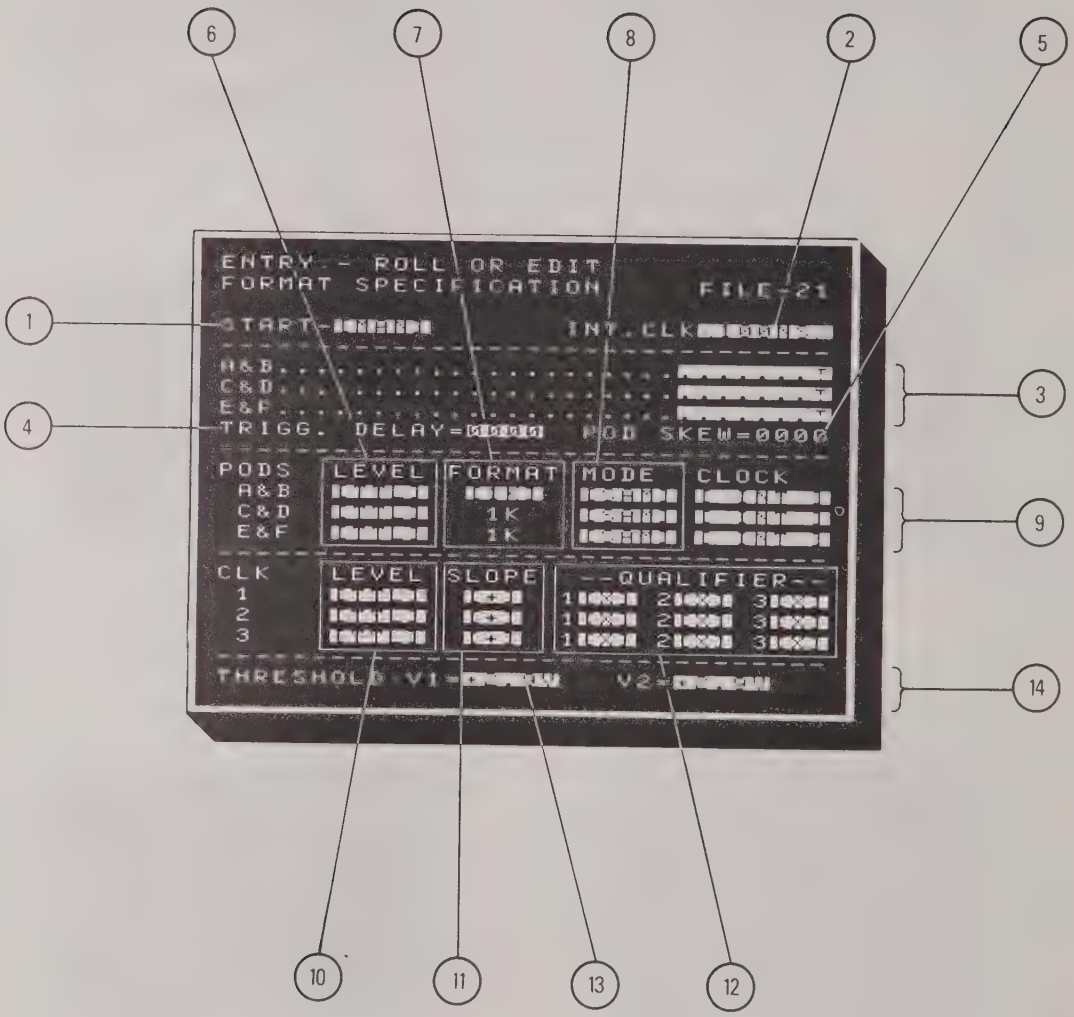



FIGURE 4-8. TRACE MENU

TABLE 4-4. TRACE MENU ELEMENTS

| ITEM NO. | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | START | | Displays type of recording initialization. |
| | | MAN | Indicates "Manual" mode of data recording. |
| | | REP | Indicates "Repeat" mode of data recording. Subsequent recordings will be initiated automatically after a delay as defined in the "XX Second" field (up to 99 seconds). |
| 2 | INT. CLOCK | 20ns -500ms | Indicates sample rate of the internal Clock. (pre-selected at 100 ns) |
| 3 | (BAR GRAPH) | 1K Format 2K Format | Displays in graphic form, the organization of data memory. (See Item No.7) |
| 4 | TRIGGER DELAY | 0-8192 memory locations | Indicates the defined Trigger word location in data memory. Position is indicated in the Bar Graph with "T". |
| 5 | POD SKEW | 0-1000 memory locations | Indicates memory location difference (skew) between pods E+F and A+B in 2K mode relative to memory end. |
| 6 | LEVEL | | Displays type of threshold levels active for each pod group: |
| | | TTL | Transistor-to-Transistor Logic |

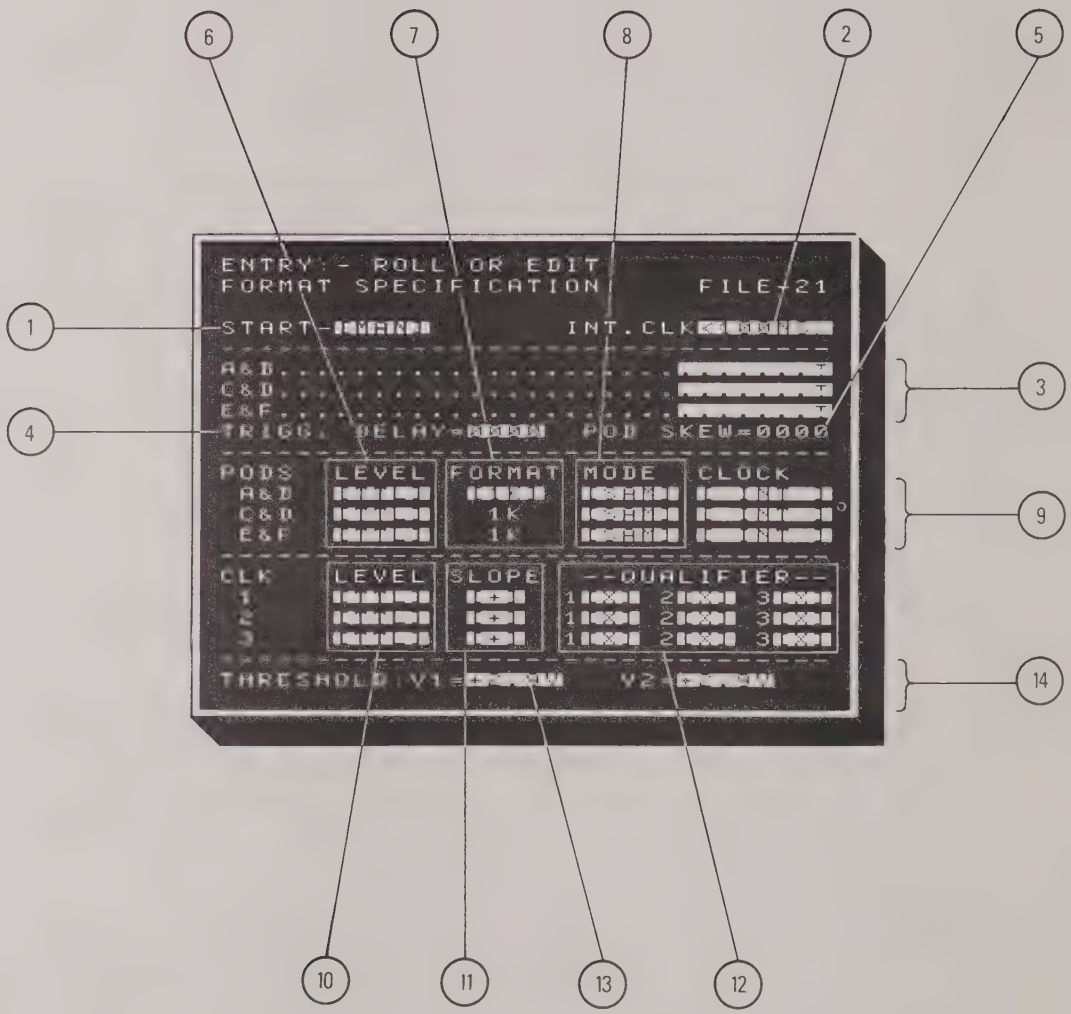



FIGURE 4-8 A. TRACE MENU

TABLE 4-4. TRACE MENU ELEMENTS (continued)

| ITEM NO. | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| | | ECL | Emitter-Coupled Logic |
| | | V1 | Variable Voltage Threshold 1 (See Item No. 13) |
| | | V2 | Variable Voltage Threshold 2 (See Item No. 14) |
| 7 | FORMAT | | Displays memory format of SBLA's (See Item No. 3) |
| | | 1K | 48 bit |
| | | 2K | 32 bit with Pods C + D turned OFF. |
| 8 | MODE | | Displays recording mode selected for each recording block. |
| | | SAM | Sample Mode. |
| | | LAT | Latch Mode (glitch catching) for Pods A + B only |
| | | OFF | Pod group is turned OFF. |
| 9 | CLOCK | | Displays clock(s) source active for each pod group. |
| | | *INT | Internal Clock |
| | | C1 | External Clock #1 |
| | | C2 | External Clock #2 |
| | | C3 | External Clock #3 (E+F only) |
| | | INT + 1 | Internal Clock "OR"ed with C1 |
| | | INT + 2 | Internal Clock "OR"ed with C2 (C+D only) |
| | | INT + 3 | Internal Clock "OR"ed with C3 (E+F only) |
| | | C1 + C2 | External Clocks #1 + #2 "OR"ed |

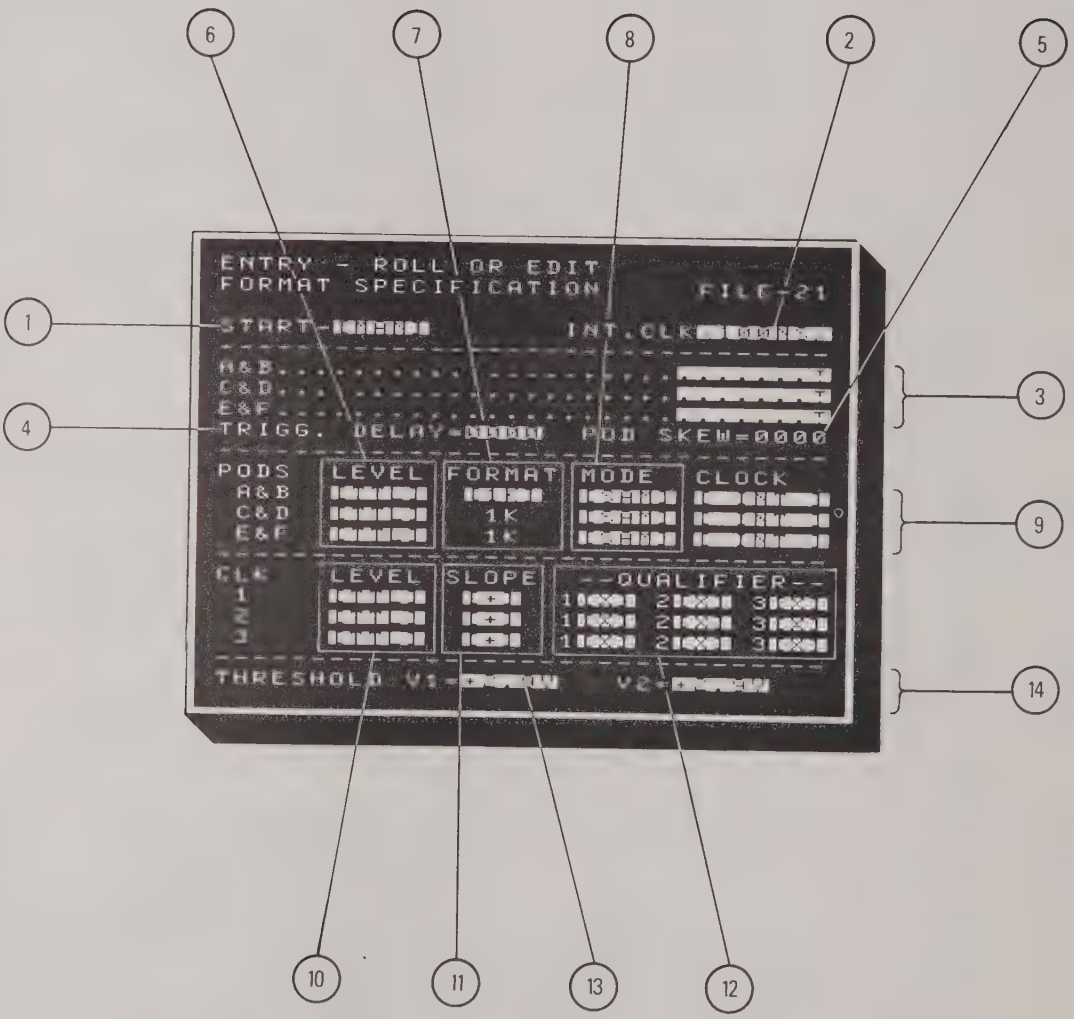



FIGURE 4-8B. TRACE MENU

TABLE 4-4. TRACE MENU ELEMENTS (continued)

| ITEM NO. | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 10 | (CLK) LEVEL | | Displays logical state of all External Clocks and qualifier inputs. Selectable for entire group. |
| | | TTL | Fixed Transistor-to-Transistor Logic level |
| | | ECL | Fixed Emitter-Coupled Logic level |
| | | V2 | Fixed variable threshold voltage 2 level |
| | | V1 | Fixed variable threshold voltage 1 level |
| 11 | (CLK) SCOPE | | Displays active edge of each External Clock. |
| | | + | Active on the rising edge |
| | | - | Active on the falling edge |
| 12 | (CLK) QUALIFIER | | Displays "Qualified" outputs of each External Clock to enable a clock count |
| | | X | Don't care |
| | | H | Qualifier must be high |
| | | L | Qualifier must be low |
| 13 | THRESHOLD: V1 | -9.9 V to +9.9 V | Displays the threshold level programmed for variable voltage number 1. Pre-set at 2.9 Volts |
| 14 | THRESHOLD: V2 | -9.9 V to +9.9 V | Displays the threshold level programmed for variable voltage number 2. Pre-set at 2.9 Volts |

* Actual order shown is different

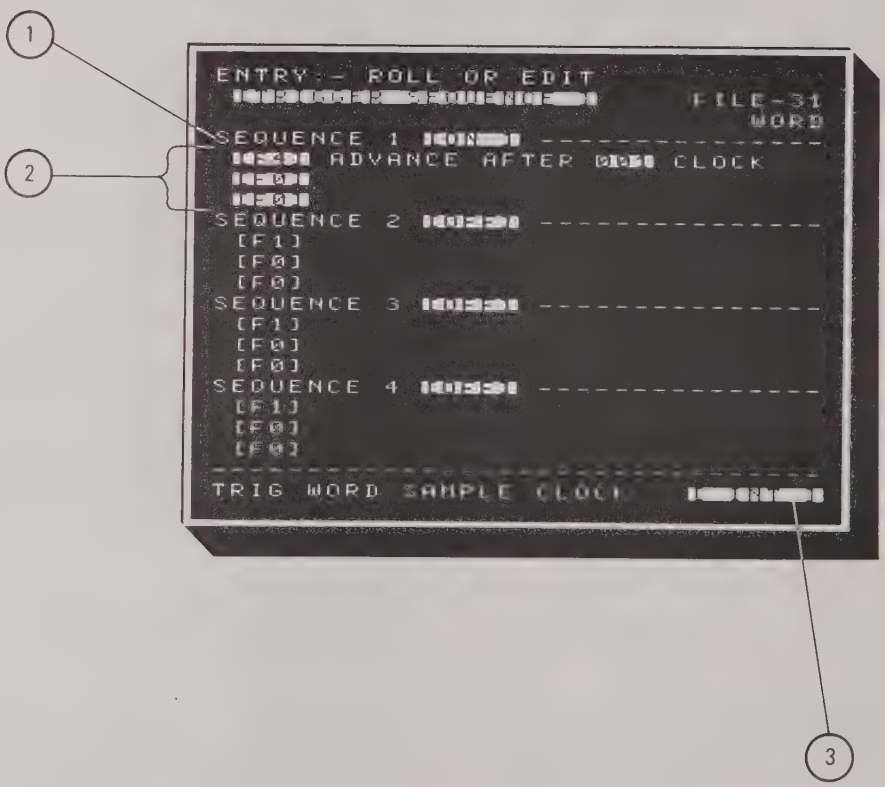



FIGURE 4-9. TRIGGER MENU

TABLE 4-5. TRIGGER MENU ELEMENTS

| ITEM NO. | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | SEQUENCE | | Indicates Sequence activity |
| | | ON | Indicates that the Sequence is active. |
| | | OFF | Indicates that the Sequence is not active. |
| 2 | F | F0-F7 | Function indicator for level in sequence. See section 5.3.3, Operating Procedures, of this manual for Function details. |
| 3 | TRIG WORD SAMPLE CLOCK | | Clock used to scan Trigger words and synchronous sequential triggering. Must be assigned to at least one active (ON) Pod group. |
| | | *INT | Internal Clock |
| | | C1 | External Clock #1 |
| | | C2 | External Clock #2 |
| | | C3 | External Clock #3 |
| | | INT+1 | Internal Clock "OR"ed with EXT.CLK 1 |
| | | INT+2 | Internal Clock "OR"ed with EXT.CLK 2 |
| | | INT+3 | Internal Clock "OR"ed with EXT.CLK 3 |
| | | C1 + C2 | External Clocks #1 + #2 "OR"ed |

*Actual order shown is different.

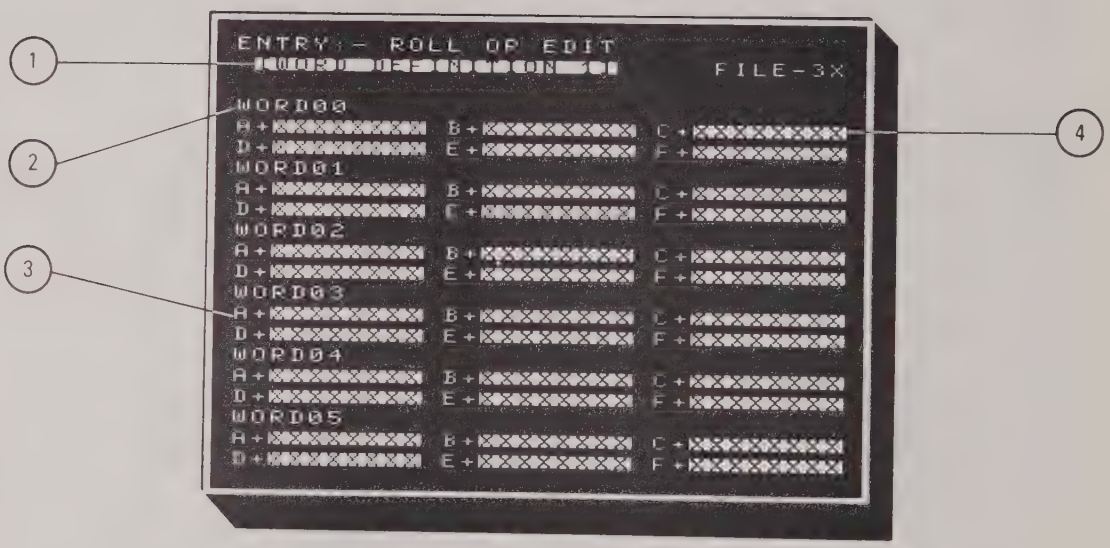



FIGURE 4-10. TRIGGER WORD DEFINITION MENU

TABLE 4-6. TRIGGER WORD DEFINITION MENU ELEMENTS

| ITEM NO. | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | WORD DEFINITION | | Displays which page of the TRIGGER WORD DEFINITION is active. |
| | | 1 | Page 1 active |
| | | 2 | Page 2 active |
| 2 | WORD | | Displays the Triggerword field |
| | | 00-05 | Words 00-05, Page 1 |
| | | 06-11 | Words 06-11, Page 2 |
| 3 | A-F | | Displays Pod Group(s) for Triggerword programming |
| | | + | Positive Polarity |
| | | - | Negative Polarity |
| 4 | (WORD CONFIGURATION) | | Displays Triggerword configuration programmed. |
| | | BIN | Binary assignment of Triggerword values. |
| | | HEX | Hexadecimal assignment of Triggerword values. |
| | | OCT | Octal assignment of Triggerword values. |
| | | X | Don't Care |
| | | 1 | Logical One (in Binary) |
| | | 0 | Logical Zero (in Binary) |

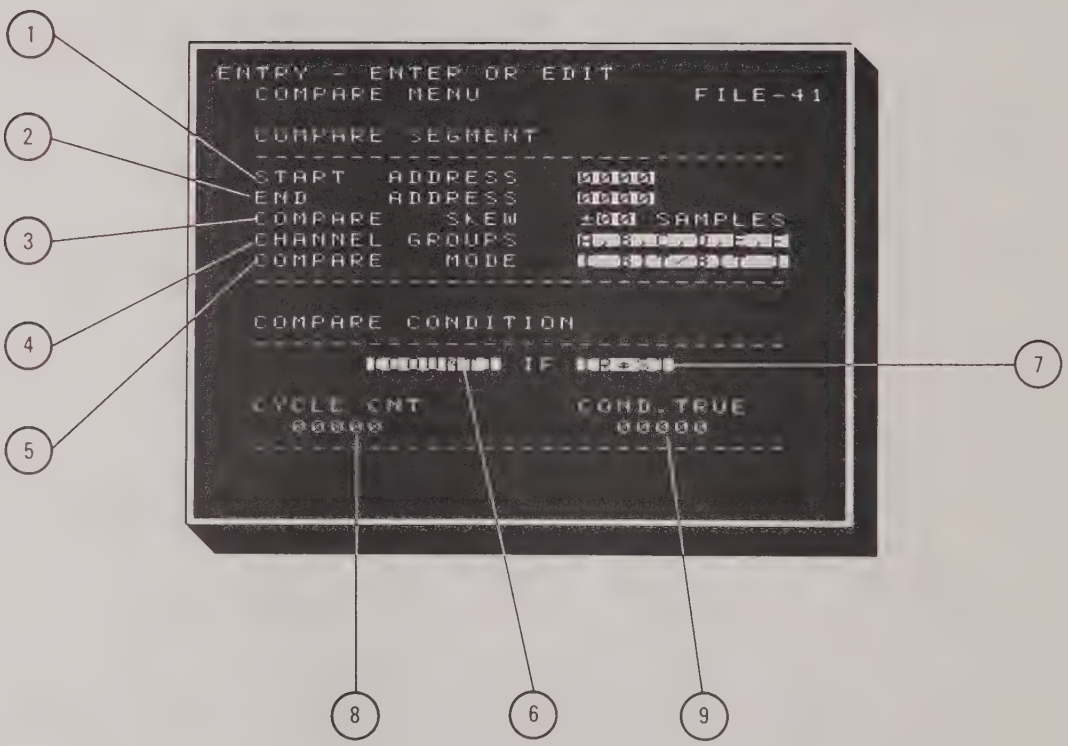



FIGURE 4-11. COMPARE MENU

TABLE 4-7. COMPARE MENU ELEMENTS

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | START ADDRESS | 0-0999 Memory locations In 1K Format 0-1999 Memory locations in 2K Format | Displays the memory location where the compare mode begins in the internal memory |
| 2 | END ADDRESS | 0-0999 Memory locations in 1K Format 0-1999 Memory locations in 2K Format | Displays the memory location where the compare mode ends in the internal memory. |
| 3 | COMPARE SKEW | +/-0-99 Memory locations | Displaysthe tolerance area for error ( or data mismatch ) around every programmed location of the Reference Memory, as compared to the Source Memory. This is expressed as + or - "XX" Samples. |
| 4 | CHANNEL GROUPS | A - F | Displays the Pod Groups active in the Compare mode. |
| 5 | COMPARE MODE | | Displays the type of Comparison activity to be done. |
| | | BIT/BIT | Indicates comparison between the Reference Memory and Source Memory is on a Bit-by-Bit basis, within the tolerance area programmed. |

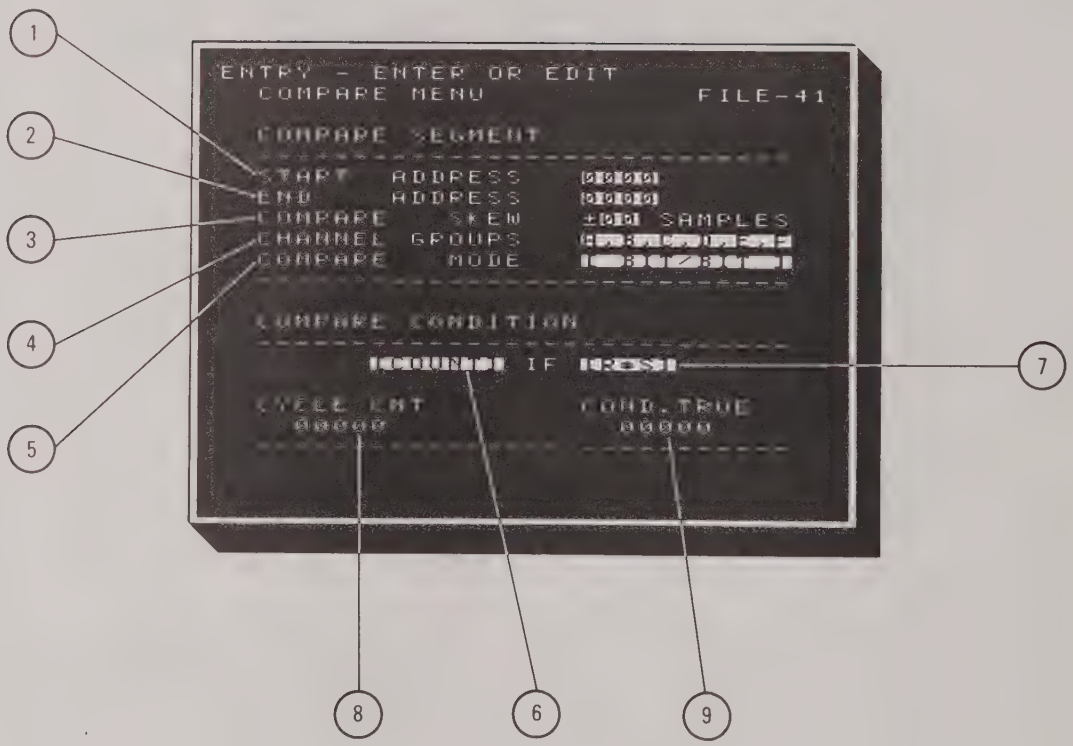



FIGURE 4-11A. COMPARE MENU

TABLE 4-7. COMPARE MENU ELEMENTS (continued)

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| | | BYTE/BYTE | Indicates comparison between the Reference Memory and Source Memory is on a Word-by-Word basis within the tolerance area programmed. |
| 6 | COMPARE CONDITION | COUNT | Indicates that the analyzer will increment the "Condition True" counter if a programmed condition is met. |
| | | HALT | Indicates that the analyzer will stop if a programmed condition is met. |
| 7 | COMPARE CONDITION | R = S | Indicates that the Reference Memory data must be equal to the Source Memory data to satisfy a compare condition. |
| | | R ≠ S | Indicates that the Reference Memory data must not be equal to the Source Memory data to satisfy a compare condition. |
| 8 | CYCLE CNT (XXXX) | | Displays the number of times the Cycle Counter has been incremented at every recording during the compare mode. |
| 9 | COND. TRUE (XXXX) | | Displays the number of times a preprogrammed compare condition is true during a recording. |

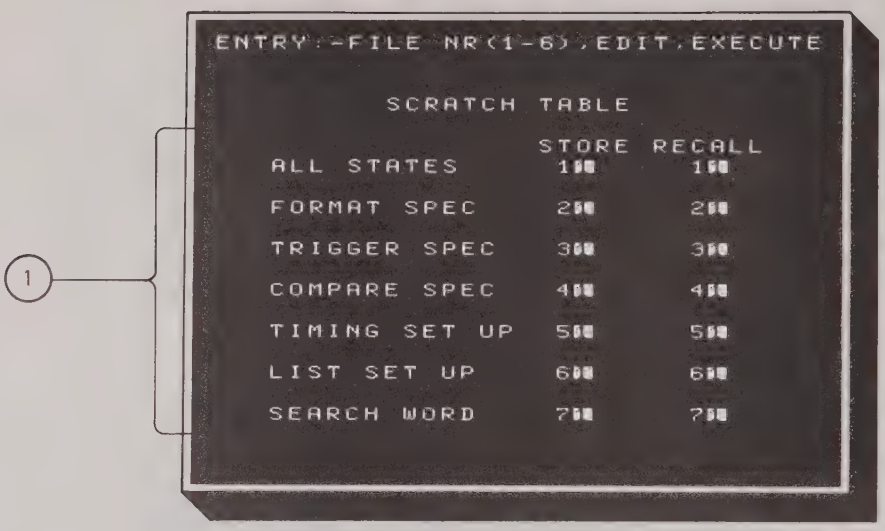



FIGURE 4-12. SCRATCH TABLE

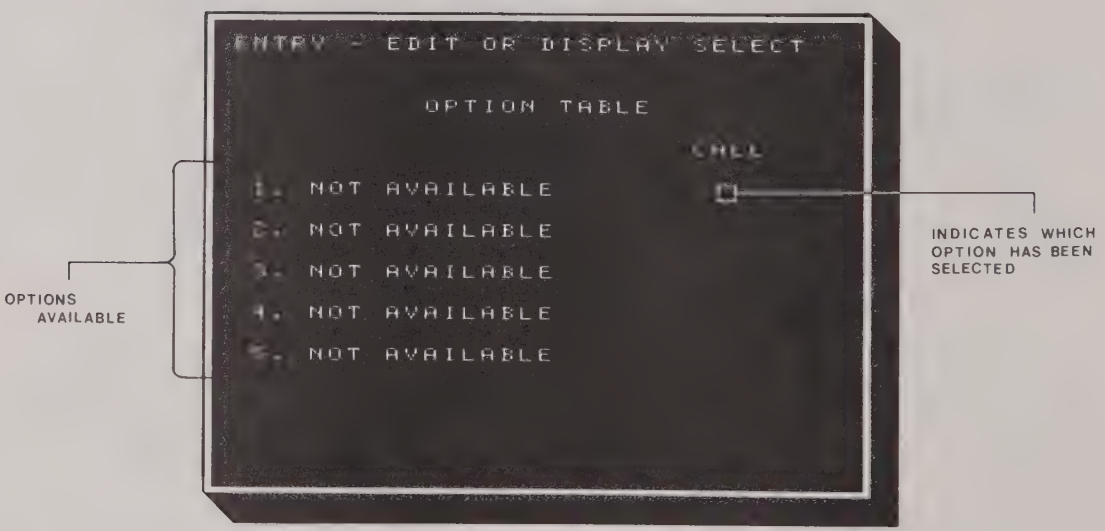



FIGURE 4-13. OPTION TABLE

TABLE 4-8. SCRATCH TABLE ELEMENTS

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | STORE | | Displays file number selected for storage of each type of file. |
| | RECALL | | Displays file number selected for recall of each type of file. |
| | | 1-6 files each type | List of the type of files to be stored or recalled |

## 4.4 DISPLAYS

The LAM 4850A features five displays associated with the Data Analysis Mode of operation:

- Timing Diagram
- Timing Diagram Word Search
- Timing Diagram Sequence Search
- List Display
- List Display Sequence Search

Figure 4-14 shows the means to access these displays.

The list below indicates the Figure and Table number describing it, for each display in the following section.

| DISPLAY | FIGURE | TABLE |
|---|---|---|
| TIMING DIAGRAM | 4-16 | 4-9 |
| SEQUENCE SEARCH | 4-17 | 4-10 |
| TIMING DIAGRAM SEARCH WORD | 4-18 | 4-11 |
| LIST | 4-19 | 4-12 |
| LIST WORD SEARCH | 4-20 | 4-13 |

## 4.5 MONITORS

The LAM 4850A features three types of monitors of system operation:

- Trace/Trigger Monitor
- Valid Set up
- Set up Check Results

Figure 4-15 shows the means to access these displays.

Figure 4-21 shows an illustration of the Trace/Trigger Monitor, and Table 4-14 describes its elements. Figure 4-22 shows some typical examples of the Set-up Monitors.

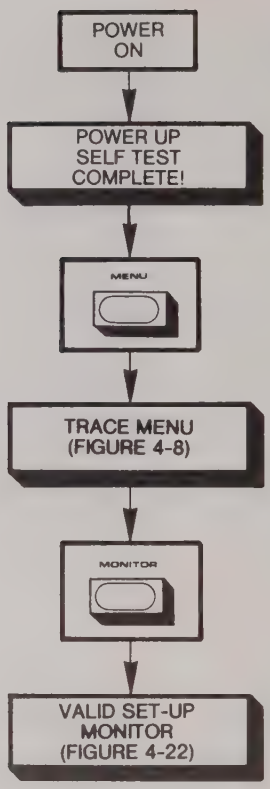



FIGURE 4-15. MONITOR ACCESS

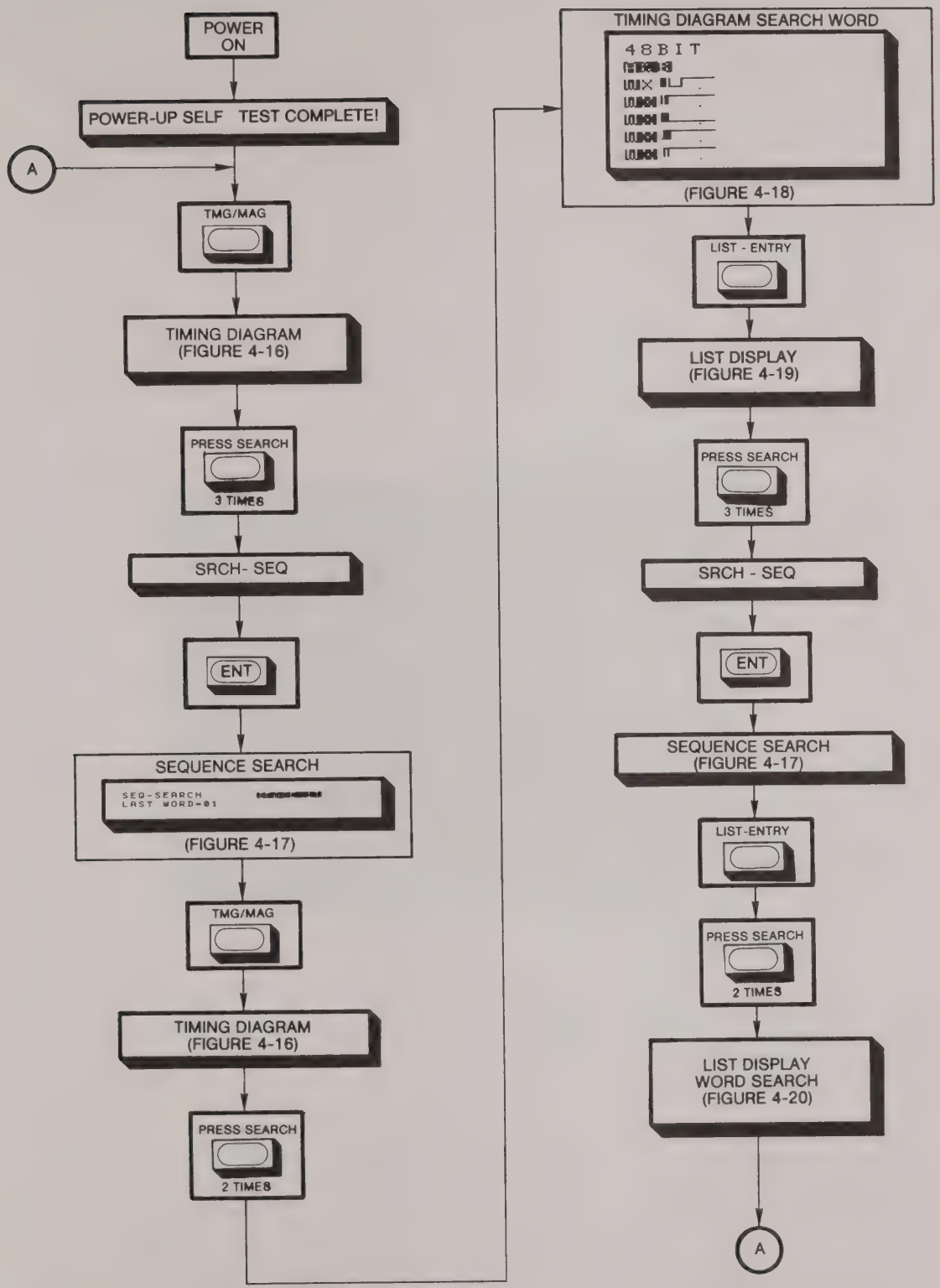



FIGURE 4-14. DISPLAY ACCESS

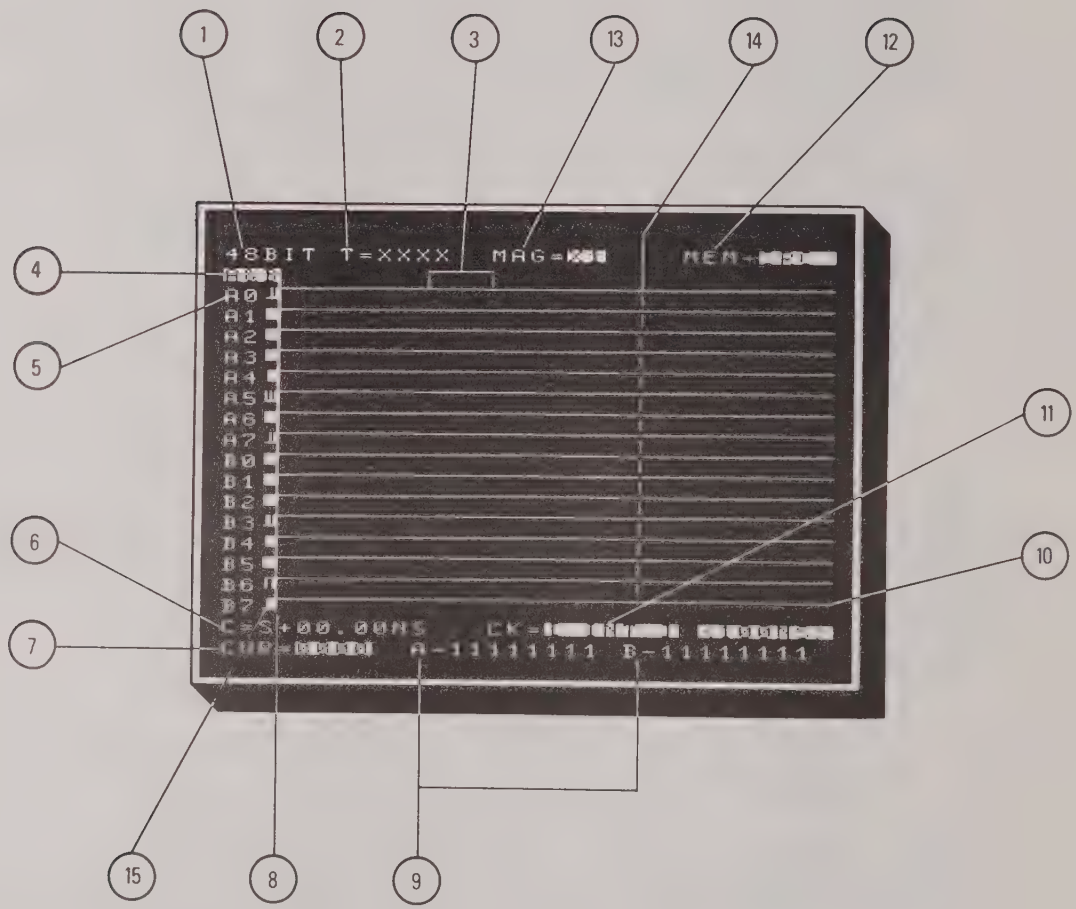



FIGURE 4-16. TIMING DIAGRAM

TABLE 4-9. TIMING DIAGRAM ELEMENTS

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | (RECORDING FORMAT) | | Displays the recording format used. |
| | | 48 BIT | Indicates that all SBLA's were configured for 16 channels X 1K words of memory during recording. |
| | | 32 BIT | Indicates that Pod Group A + B was configured for 16 channels X 2K words of memory, while Pod Group E + F was configured for 16 channels X 1K words of memory during recording. |
| 2 | T = | 0-999 (48 Bit)<br>0-1999 (32 Bit)<br>XXXX | Displays the programmed Trigger word location. Represents the maximum of locations minus the trigger delay. "XXXX" indicates that the Trigger word is outside the memory or that there is no Trigger. |
| 3 | (TIMING MARKERS) | | Indicates 100 memory locations in 1K Format mode, and 200 locations in 2K Format. |
| 4 | (POD GROUP LABEL) | A + B<br>C + D<br>E + F | Indicates TIMING DIAGRAM displayed for a selected Pod group. |
| 5 | (CHANNEL NAME) | | Indicates channel or word name of group displayed. |

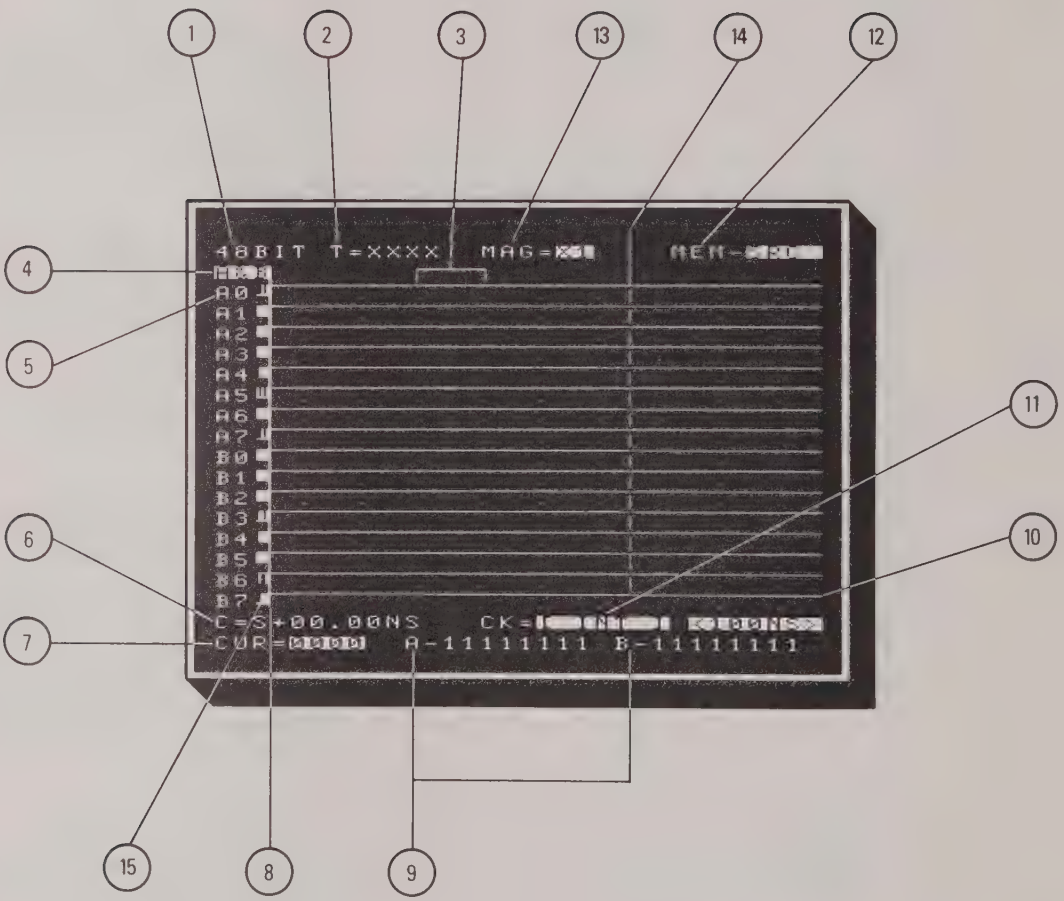



FIGURE 4-16A. TIMING DIAGRAM

TABLE 4-9. TIMING DIAGRAM ELEMENTS (continued)

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 6 | C = S (+/-) XXXX | | Displays the time measurement expressed as the difference between the actual cursor position and the Set point. |
| 7 | CUR = XXXX | | Displays actual cursor position. |
| 8 | (CURSOR LINE) | | Indicates the cursor position for all channels (Pod groups) displayed. |
| 9 | (BINARY INFORMATION) | | Displays the logical state of each channel for the Pods displayed in Binary. |
| 10 | (LOGIC STATE) | | Displays the logical state of each channel as "High" or "Low". |
| 11 | CK = XX | INT<XXX><br>C1<br>INT + <XXX><br>C1 + C2 | Displays the Clock selected for recording. Also displays sample rate of Internal Clock. Pre-set at 100 ns at power-on. |
| 12 | MEM | | Displays the type of Memory function selected for analysis. |
| | | S R C<br>S + R<br><br>S -> R | Source Memory<br>Source and Reference ("OR")<br>Source assigned to Reference |

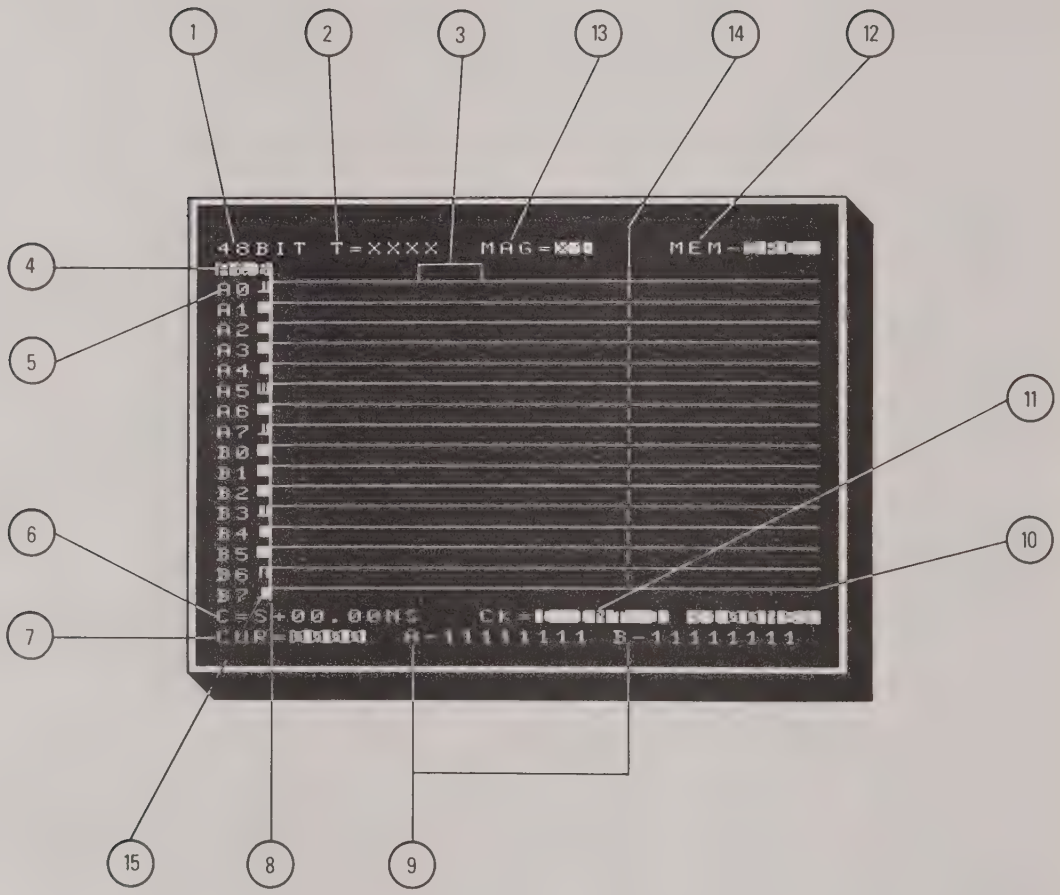



FIGURE 4-16B. TIMING DIAGRAM

TABLE 4-9. TIMING DIAGRAM ELEMENTS (continued)

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| | SRCH | | Displays the type of Search function selected for analysis. |
| | | S = R | Source is equal to Reference Memory |
| | | S ≠ R | Source not equal to Reference Memory |
| | | S E Q | Sequential Word Search |
| | | W O R D | Word Search |
| 13 | MAG | X1<br>X5<br>X10<br>X20 | Displays the "Magnification" level selected for the TIMING DISPLAY. |
| 14 | (TRIGGER WORD MARK) | | Non-moving vertical line that indicates the Triggerword location. |
| 15 | (RANDOM DATA) | | These are the first 24 data locations used by software for internal functions. These locations are not accessible by the user. |

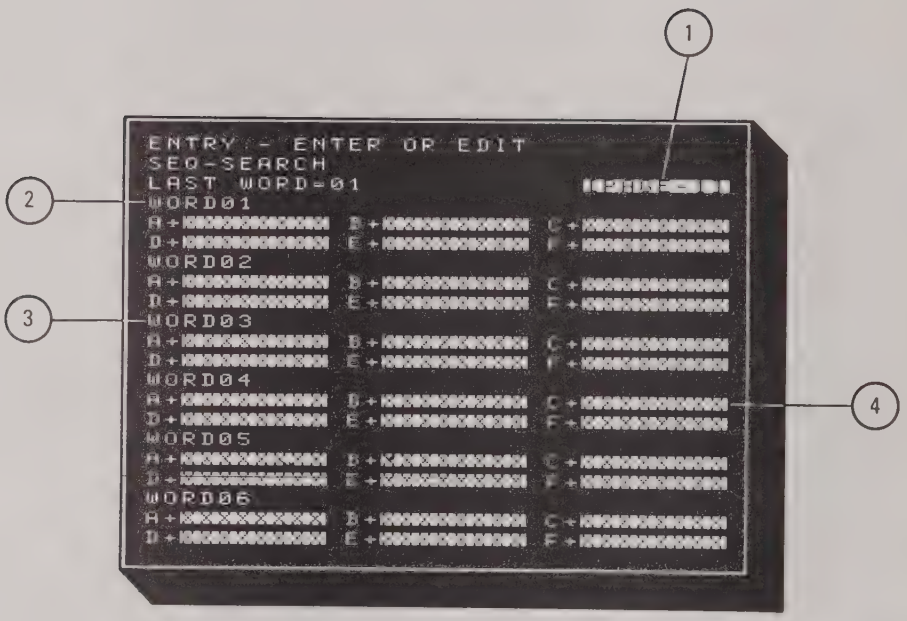



FIGURE 4-17. SEQUENCE SEARCH MENU

Table 4-10 SEQUENTIAL SEARCH DISPLAY ELEMENTS

| ITEM NO. | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | PAGE | | Displays which page of the SEQUENCE SEARCH DISPLAY is active. |
| | | 1 | Page 1 active. |
| | | 2 | Page 2 active. |
| 2 | WORD | | Displays the Triggerword field. |
| 3 | A - F | | Displays Pod Group(s) for Triggerword programming. |
| 4 | (WORD CONFIGURATION) | | Displays Triggerword configuration programmed. |
| | | BIN | Binary assignment of Triggerword values. |
| | | HEX | Hexadecimnal assignment of Triggerword values. |
| | | OCT | Octal assignment of Triggerword values. |
| | | X | Don't Care |
| | | 1 | Logical One (In Binary) |
| | | 0 | Logical Zero (In Binary) |

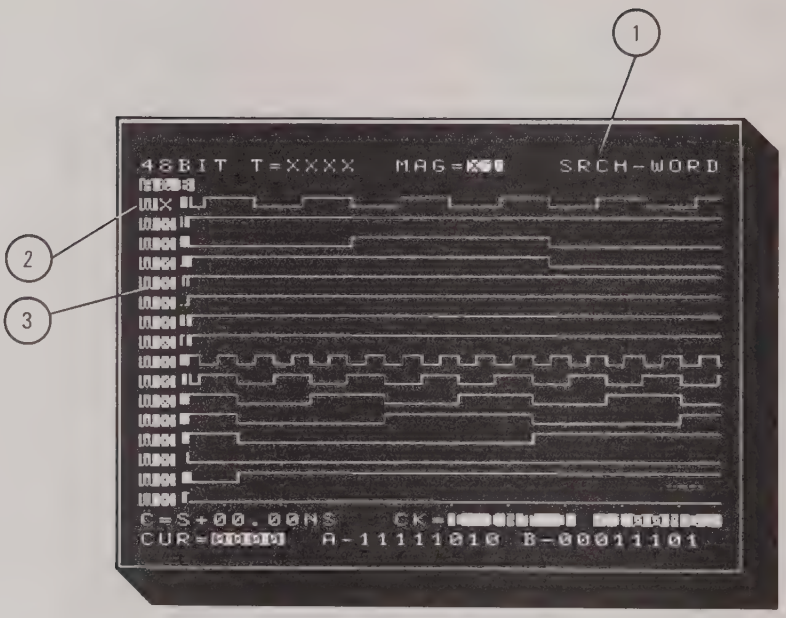



FIGURE 4-18. TIMING DIAGRAM WORD SEARCH

Table 4-11. TIMING DIAGRAM SEARCH WORD DISPLAY ELEMENTS *

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | SEARCH | WORD | Indicates that the "WORD" search for TIMING DISPLAY is selected. |
| 2 | W | | "WORD" configuration marker |
| 3 | X | | Blinking cursor shows current value inputed. |
| | | 1 | Logical "1" |
| | | 0 | Logical "0" |
| | | X | Don't Care |

* All other elements are the same as in the TIMING DIAGRAM (See Figure 4-16).

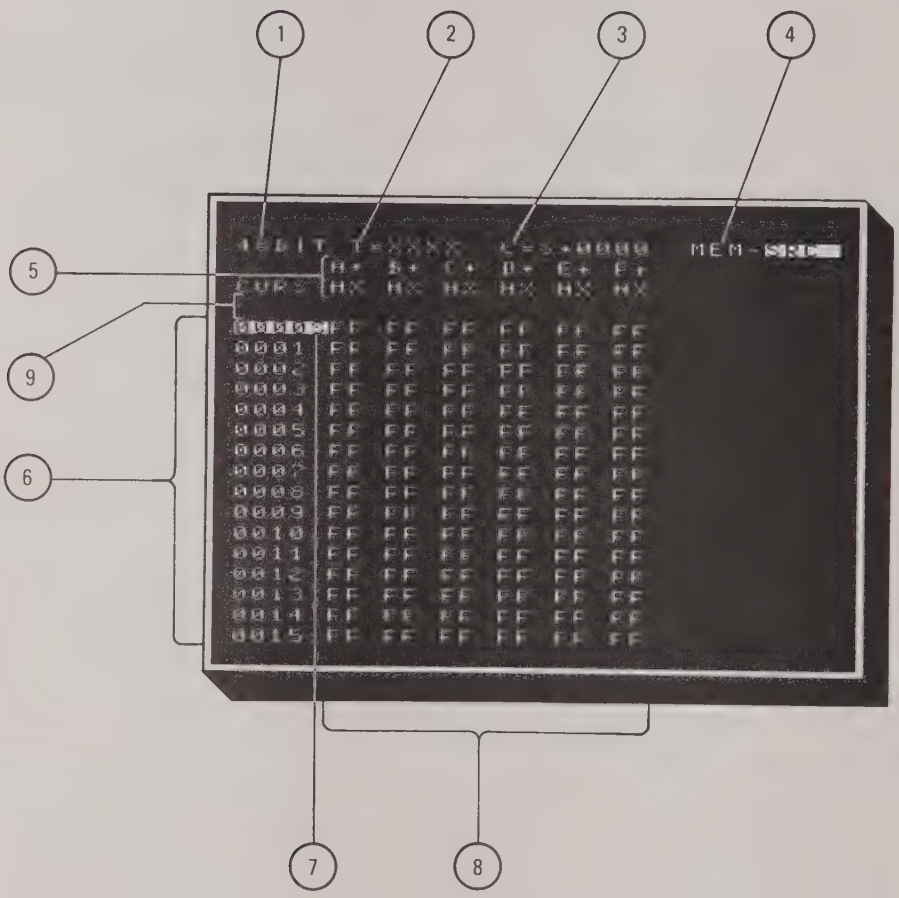



FIGURE 4-19. LIST DISPLAY

TABLE 4-12. LIST DISPLAY ELEMENTS

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | XX BIT | 48 BIT<br>32 BIT | Displays recording mode used during the last recording. |
| 2 | T = XXXX | | Displays programmed Triggerword location. See Table 4-9, Item 2. |
| 3 | C = S (+/-)XXXX | | Displays memory location expressed as the difference between the present memory location and the set point selected. |
| 4 | MEM | SRC<br>REF<br>R+S<br>S+R<br>S->R | Displays the type of Memory function selected for analysis. |
| | SRCH | S=R<br>S≠R<br>SEQ<br>WORD | Displays the Search function selected for analysis. |
| 5 | (POD GROUP SELECT) | | Displays the following information:<br>1) Pod group active<br>2) Polarity of Pod group<br>3) Number base of Pod group |
| 6 | CURS | | Shows actual memory addresses of the analyzer. |
| 7 | S | | Displays the present "Set" point selected. |

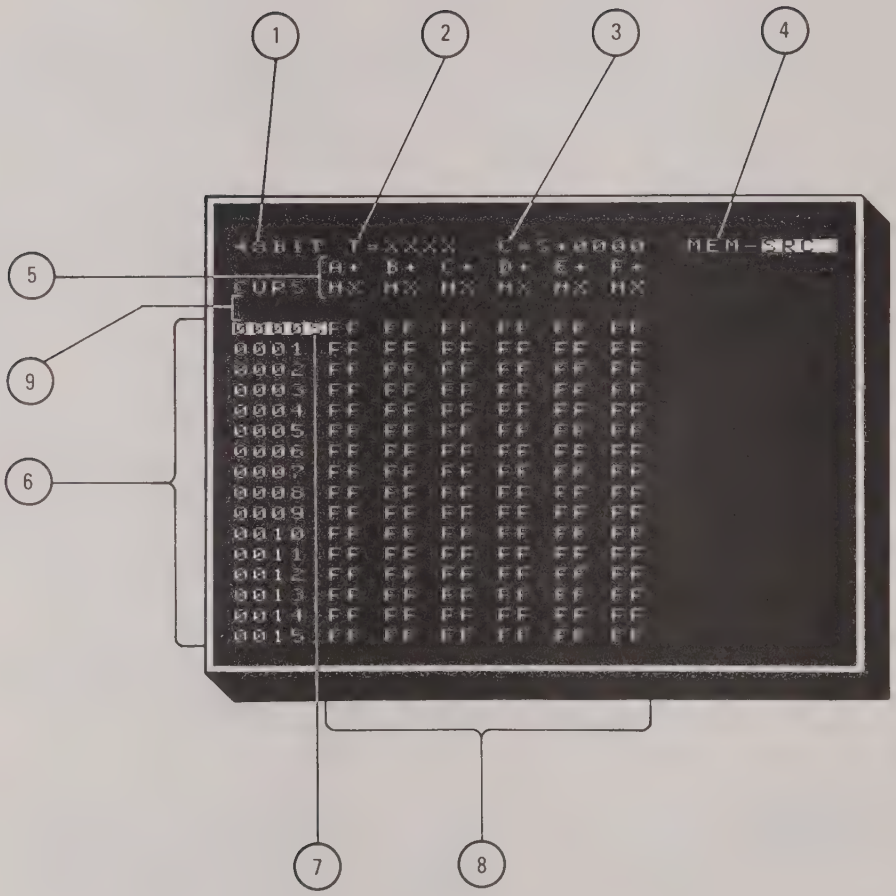

1
2
3
4
5
9
6
7
8
8BIT T=XXXX C=S+0000 MEM-SRC
A+ B+ C+ D+ E+ F+
CURS MX MX MX MX MX MX
0000 FF FF FF FF FF FF
0001 FF FF FF FF FF FF
0002 FF FF FF FF FF FF
0003 FF FF FF FF FF FF
0004 FF FF FF FF FF FF
0005 FF FF FF FF FF FF
0006 FF FF FF FF FF FF
0007 FF FF FF FF FF FF
0008 FF FF FF FF FF FF
0009 FF FF FF FF FF FF
0010 FF FF FF FF FF FF
0011 FF FF FF FF FF FF
0012 FF FF FF FF FF FF
0013 FF FF FF FF FF FF
0014 FF FF FF FF FF FF
0015 FF FF FF FF FF FF

FIGURE 4-19A. LIST DISPLAY

TABLE 4-12. LIST DISPLAY ELEMENTS (continued)

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 8 | (GROUP DATA) | | Displays selected contents of all data recorded for each active Pod group. |
| 9 | (CHANNEL ARRANGEMENT MONITOR) | | Used to add or change a desired channel. Appears if "HOME" pushbutton is pressed. |

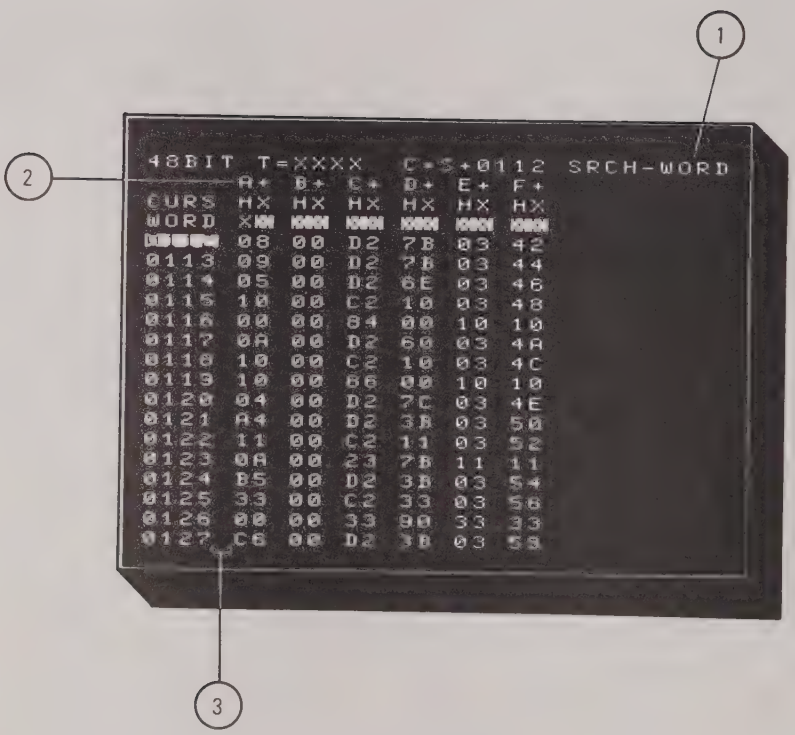



FIGURE 4-20. LIST DISPLAY WORD SEARCH AND SEQUENTIAL SEARCH

TABLE 4-13. LIST DISPLAY SEARCH WORD AND SEQUENTIAL SEARCH ELEMENTS

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | SEARCH | WORD<br>SEQ | Indicates that the Search function is selected for the LIST DISPLAY. |
| 2 | (WORD ENTRY FIELD) | XX | Words for Word Search are entered in this field. |
| 3 | (EVENTS) | > | Column that indicates occurances of search events with the "greater than" sign after the Sequential Search is ended. |

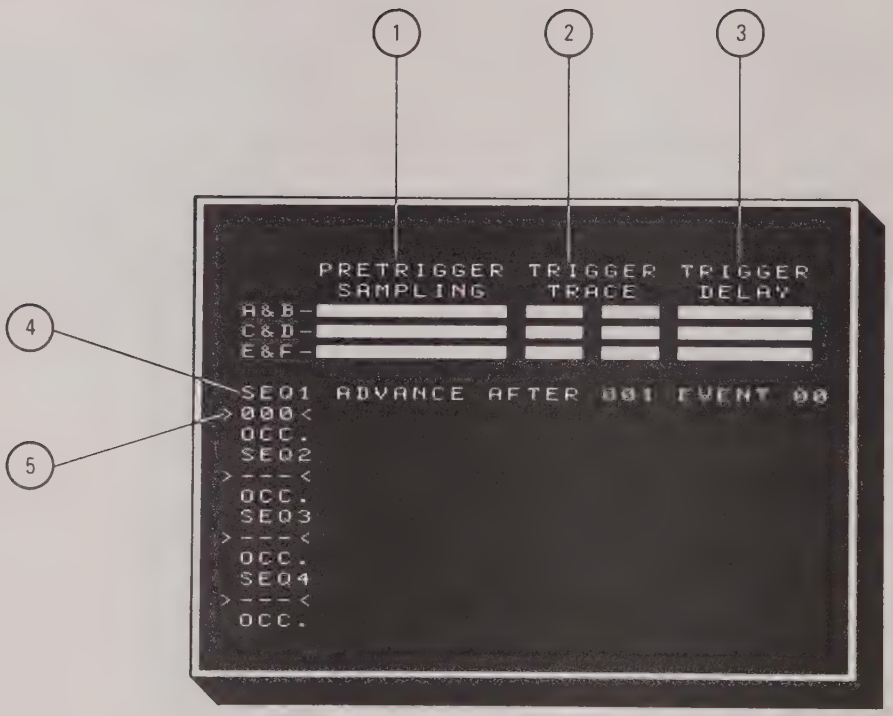
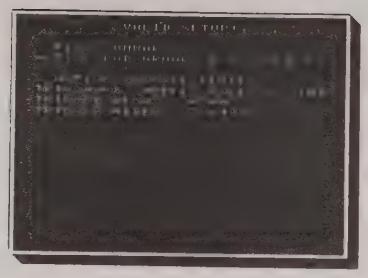
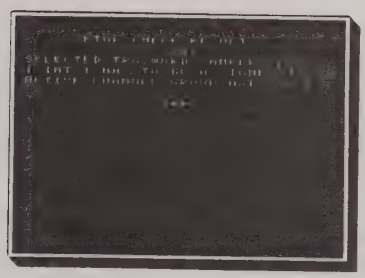



FIGURE 4-21. TRACE / TRIGGER MONITOR

TABLE 4-14. TRACE/TRIGGER MONITOR ELEMENTS

| LOC COR | FIELD HEADING | PARAMETERS | DESCRIPTION |
|---|---|---|---|
| 1 | PRETRIGGER SAMPLING | | Indicates the Pre-trigger Sampling activity for each memory block during recording. |
| 2 | TRIGGER TRACE | | Indicates the Trigger Trace activity for each memory block during recording. |
| 3 | TRIGGER DELAY | | Indicates the Trigger Delay activity for each memory block during recording. |
| 4 | SEQ X | | Displays the sequence and level function activity in the TRIGGER MENU. |
| 5 | >XXX< OCC. | | Indicates the number of occurances of a particular event as programmed in the TRIGGER MENU during the Trigger Trace activity. |





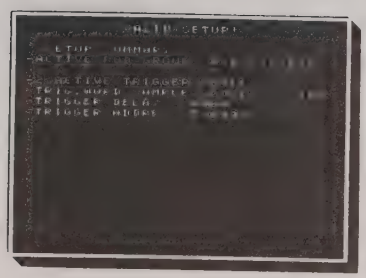


FIGURE 4-22. SET-UP MONITOR DISPLAYS

SECTION 5

OPERATING PROCEDURES

## 5.1 GENERAL

This section describes detailed operating procedures for the following modes of LAM 4850A operation:

- Pre-Record Programming
- Data Recording
- Data Analysis
- File Manipulation

Operating procedures for menus and displays used to control parameters are presented on a theoretical basis and as specific procedures (generally in a flowchart form).

NOTE

Refer to Figure 5-1, Overall Functional Family Tree at the end of this section. This figure is on fold-out sheets that provide easy reference to all functions available for the various displays and menues, and where to locate a description of them in this section.

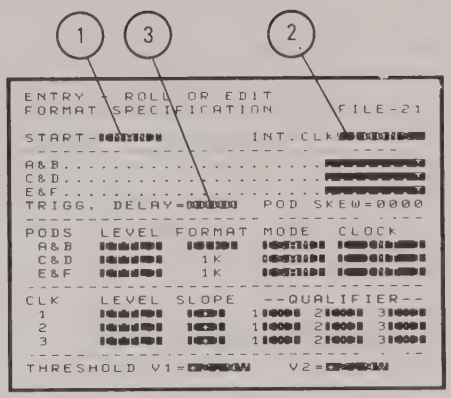
## 5.2 BASIC PROGRAMMING RULES

Programmable and selectable parameters are shown in inverse video, and are located in the menues and displays in what are called "fields". When a field is active it blinks off and on, indicating the present cursor position in the menu or display. There are a number of ways to program parameter fields. Figure 5-2 shows the types of parameter inputs listed below:

- Bracket Input Types 1
- Range Selection Input Types 2
- Non-Bracketed Input Types 3

### 5.2.1 Bracket Input Types

Refer to Figure 5-3 for Bracket Input Types. These are Group Controls before parameters are selected by pressing (or pressing and holding) the "ROLL" pushbutton.



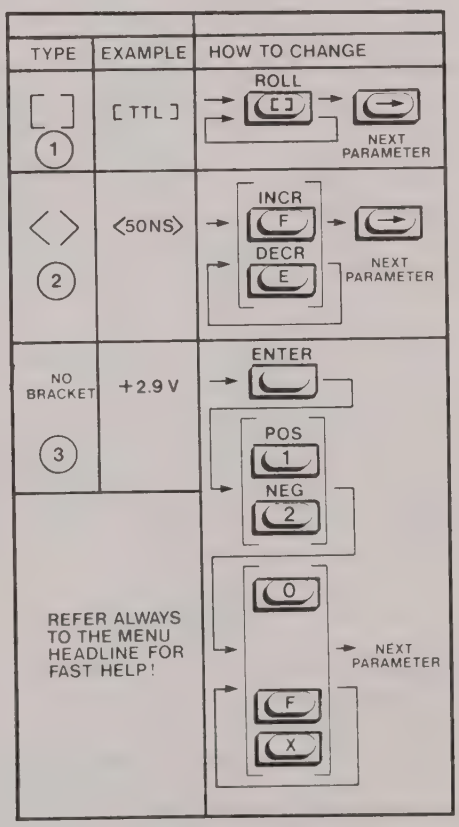




FIGURE 5-2. INPUT TYPES

### 5.2.2 Range Selection Input Types

Refer to Figure 5-4 for Range Selection Input Types. These are represented by those fields enclosed in "less than" and "greater than" signs. The cursor must be set to the desired field before increments of pre-set values may be selected by pressing (or pressing and holding) the pushbuttons labelled "9" (increment) or "8" (decrement). In the detailed procedures that follow, the allowable ranges are given.

### 5.2.3 Non-Bracketed Input Types

The Non-Bracketed Input Types are represented by fields that follow different forms. One form allows for input of digital information with the "ENTER" pushbutton before and after numbers entered. (The Cursor field needs other pushbuttons like the "LOC-entry" for initial input). Another form allows numerical or other symbolic entry without use of the "ENTER" pushbutton. For this form, it may only be necessary to advance the cursor to the desired field and input program data.

Figure 5-5A shows Non-Bracketed Input Types, and the procedure to be used with the "ENTER" pushbutton. Figure 5-5B shows Non-Bracketed Input Types, and the procedures to be used for those fields that do not require the "ENTER" pushbutton before or after selection of input data.

### 5.2.4 How To Reach Parameters

Movement of the blinking cursor during menu programming is controlled by the cursor pushbuttons in the "EDIT Group" of the keyboard. (See Figure 4-5 and Table 4-3). Pressing a pushbutton sends the blinking cursor to the next possible field in the direction chosen. The "HOME" pushbutton sends the cursor immediately back to the first programmable field in the upper part of the menu or display. See Figure 5-6 for details on the line structure and cursor controls.

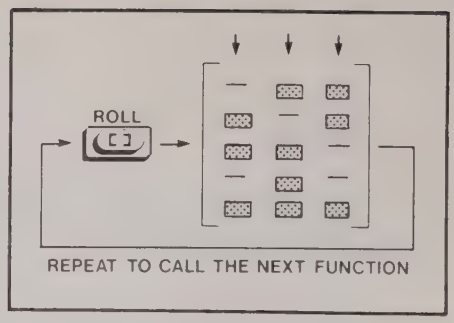
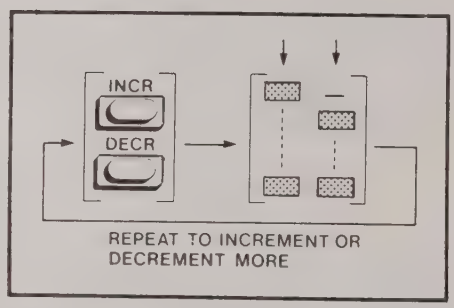
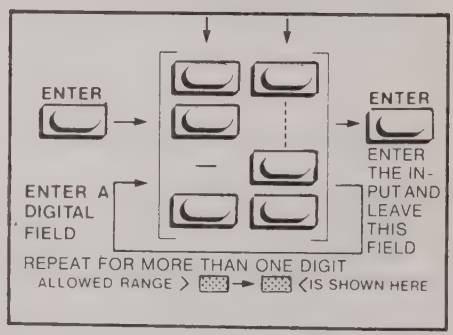



FIGURE 5-3. BRACKET TYPE INPUTS




A FIGURE 5-4. RANGE SELECTION INPUT TYPES


ENTER
ENTER
ENTER THE INPUT AND LEAVE THIS FIELD
ENTER A DIGITAL FIELD
REPEAT FOR MORE THAN ONE DIGIT
ALLOWED RANGE > → <IS SHOWN HERE

B

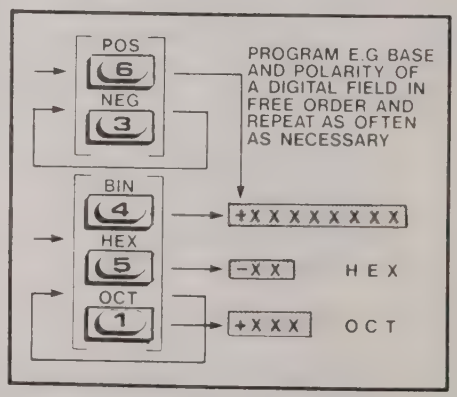



FIGURE 5-5. NON-BRACKET INPUT TYPES

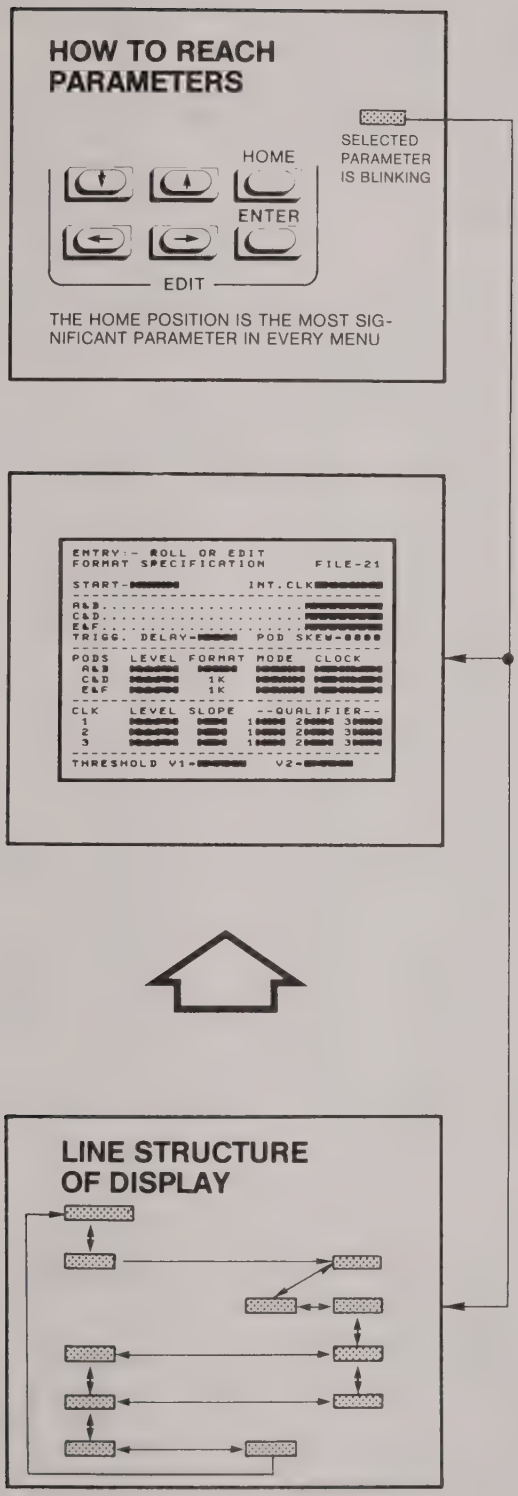



FIGURE 5-6. HOW TO REACH PARAMETERS

### 5.2.5 How To Call Menues And Displays

Refer to Figure 5-1 at the end of this section, Overall Functional Family Tree for an illustration of how to call menues and displays. These can be called after the "Pre-Power Self Test Complete" is displayed on the CRT.

## 5.3 PRE-RECORD PROGRAMMING MODE

In the Pre-Record Programming Mode, the recording parameters of the analyzer are given as a set of instructions on Menues. The LAM 4850A uses a tiered structure for programming these instructions. There are several functions associated with this mode. Each one provides a subset of instructions that are independent, starting from a high level and ending in a bit-to-bit lower level. The first instruction set represents the Trace Function (accessed by the TRACE MENU), which sets up the major parameters of the recording. With it, the user provides what amounts to the "rules of play" for the analyzer. The second instruction set represents the Trigger Function (accessed by the TRIGGER MENU), which defines the sequence of trigger activity, as well as specific commands to be carried out in each sequence. Associated with the TRIGGER MENU (on a further, more detailed level) are two "pages" called TRIGGER WORD DEFINITIONS that allow the user to specify the exact words the analyzer is expected to find. Thus the tiered structure is organized from the general to the specific, and finally, to the detailed level of programming possibilities.

The Pre-Record Programming Mode also features several other functions that help organize data recording. The first of these is the Compare Function (accessed only when the COMPARE MENU is displayed), which allows the analyzer to compare certain aspects of a previous recording with a new recording. The results are displayed in real-time. Another function (accessed by the OPTION TABLE) provides for selection of firmware options that are not automatically implemented. The last function in the Pre-Record Programming Mode is represented by Set-Up Monitors. These prompts are displayed by the analyzer to inform the user of the status of parameters as programmed.

Detailed operational theory and specific operating procedures are provided in this section for the following:

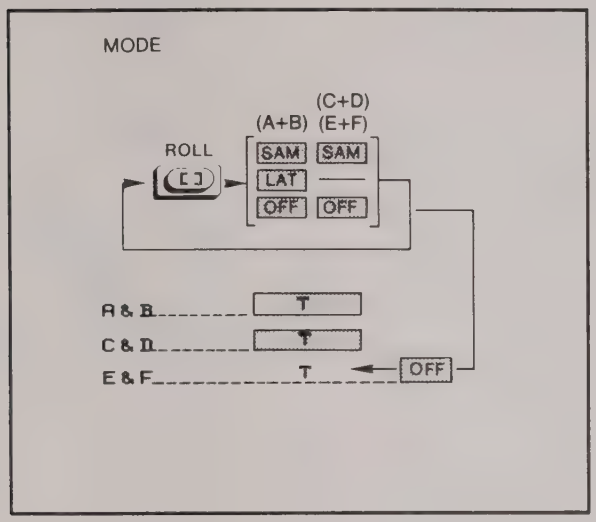
- Trace
- Trigger
- Compare
- Option Table
- Set-Up Monitors

### 5.3.1 Trace Menu Operational Theory

Refer to Figure 5-7 in the following discussion. Circle numbers are annotated to correspond to paragraphs in this section.

**5.3.1.1 Sample Mode.** Data input ALP 44's, ①, (or other input devices) provide the line receiver circuits of the input PCB's with signals of a specified level. These input channel groups (A+B, C+D, E+F) can be individually set to one of four reference voltages, as programmed in the "PODS A+B, C+D, E+F LEVEL" portion of the TRACE MENU (See ⑤). In order to sample, data must be present 15 ns before an active clock edge and 2 ns after the active clock edge.

**5.3.1.2 Latch Mode.** In addition to the normal sampling mode, Pods A + B also only feature D - Type glitch catching circuitry. These circuits are enabled when the "LATCH MODE" is selected ②. Whenever a threshold transition occurs between two successive clock intervals, a latch stores the state of the previous clock interval, thus detecting and displaying "glitches". Figure 5-8 shows the operation of the sampling modes. The minimum detectable glitch is 5 ns with 250 millivolts threshold overdrive.



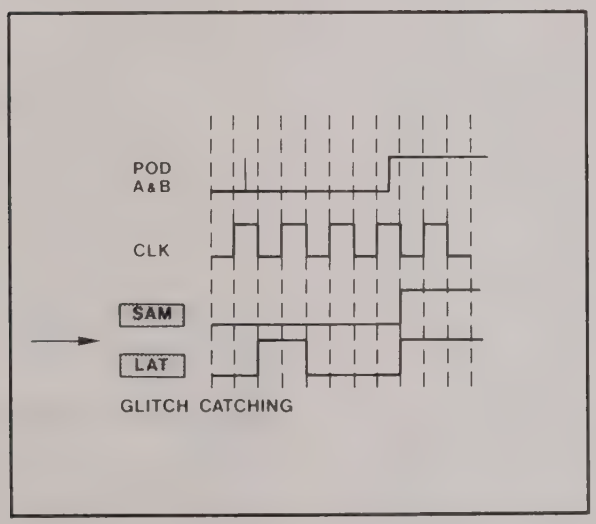




FIGURE 5-8. SAMPLING MODES

**5.3.1.3 Memory Blocks, ③ .** The SBLA's represent the memory blocks of the LAM 4850A. These SBLA's can be organized for 1K or 2K Formats. See Figure 5-9. In the 1K Format the user may select 48 channels by turning ON all Pod groups. See Figure 5-10A. In the 2K Format (where Pods A + B and C + D are combined) the user may leave Pod groups E + F ON or turn it OFF. See Figure 5-10B.

**5.3.1.4 Trigger Delay.** The Logic Analyzer can be programmed to delay the end of a recording after a specified Trigger word is recognized (the Trigger word is defined in the TRIGGER MENU). See Paragraph 5.3.3. This allows data to be recorded both before and after the Trigger word. The actual position of the Trigger word is set in the "TRIGG.DELAY" field heading and is represented as a "T" in a bar graph showing relative size and memory of each pod group. See Figure 5-11. Memory depth minus the Trigger Delay is equal to the Trigger location.

The programmed delay number is counted from the right side of the bar graph (i.e., zero is at the far right side). The dots on the time line represents 125 memory locations. Note that the location of the Trigger word may be set outside of the memory. If the number is greater than the memory depth available, it will be displayed as: "T<-". The maximum number programmable in both 1K and 2K Formats is 8192 memory locations.

**5.3.1.5. Pod Skew.** The "POD SKEW" field heading indicates the number of memory locations "skewed" before Pods E + F are told to begin recording. Refer to Figure 5 - 12. The maximum number of pod skew is 1000. Note that the Pod Skew is only programmable in the 2K Format. Since the Trigger Word location can't be set beyond the memory boundaries, any Trigger Delay desired must be greater than or equal to the programmed Pod Skew number. This is necessary because the Logic Analyzer cannot stop recording before the Trigger word is found.

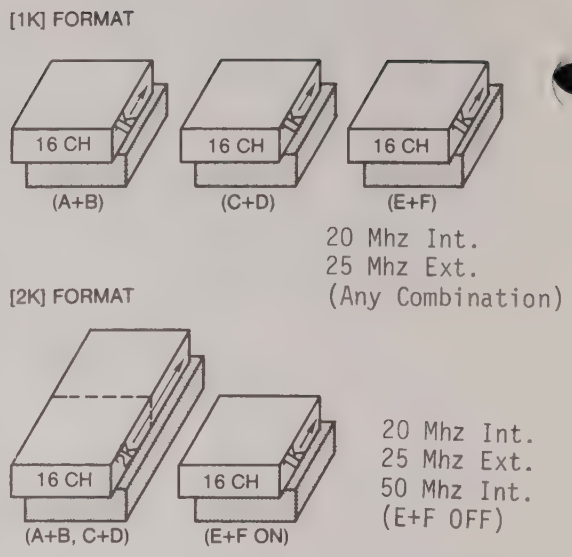



FIGURE 5-9. MEMORY BLOCK CONFIGURATIONS

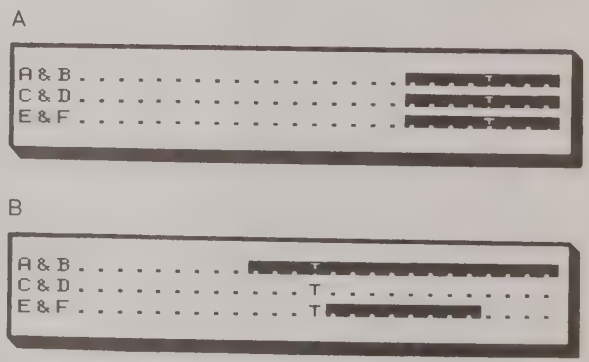
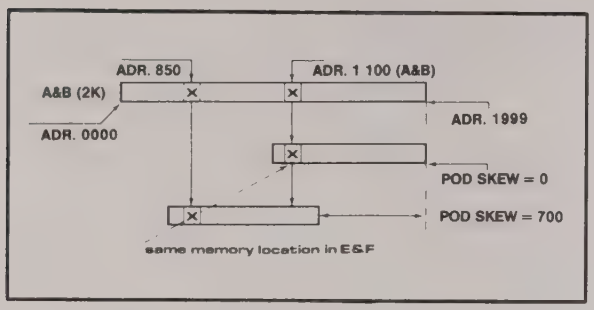



FIGURE 5-10. MEMORY FORMAT DISPLAYS

FIGURE 5-11. TRIGGER WORD



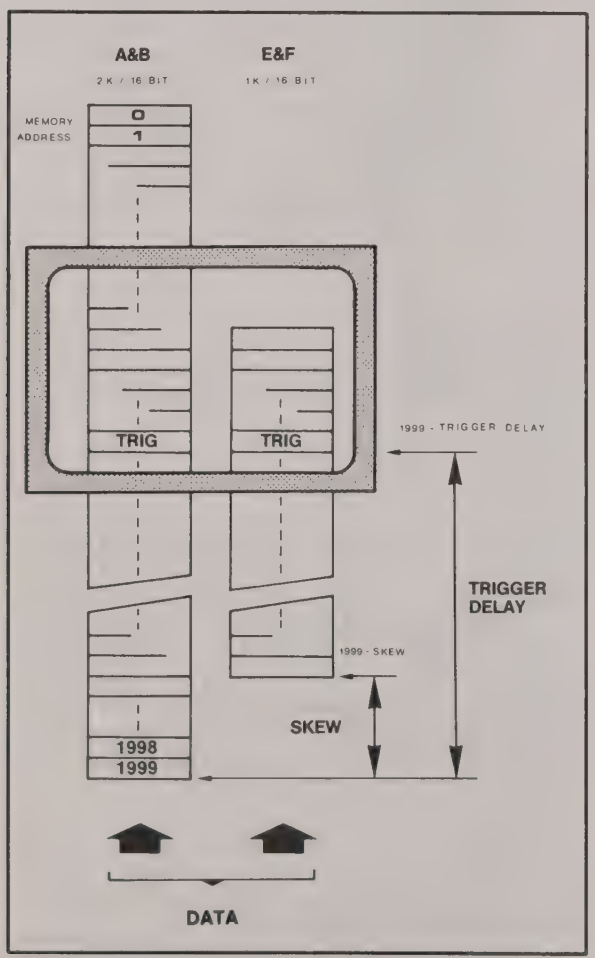




FIGURE 5-12. POD SKEW

After a recording is done, the memory location of Pods E + F when selected for display, and will be modified in accordance to the pre-programmed Pod Skew number. Therefore, the first memory location for E + F is always 1000 minus the programmed Pod Skew number.

**5.3.1.6 Threshold.** The "Threshold" throughout this documentation, and through all levels of the LAM 4850A operation, refers to the allowable threshold level of either pre-set or variable voltages that are accepted as inputs to the logic analyzer. See ④ on Figure 5-7. The two pre-set levels are TTL (+ 1.4 V) and ECL (- 1.3 V). The two variable voltages, V1 + V2, are each programmable from -9.9 volts to +9.9 volts in 0.1 volt increments.

The assigned threshold levels are sent out to the ALP's 1 and 4 through the DAC on the Threshold/GPIB PCB and a comparison is made with the incoming signal. Refer to Figure 5-13. Depending on the result, a logical HIGH or LOW level is sent back to the Logic Analyzer. Pod levels may be individually assigned, however clock and qualifier threshold levels are assigned for the entire group. Note that if used without an ALP, the assigned threshold level has no function and data must be inputed in ECL Logic.

**5.3.1.7 ALP 44.** Clock and Qualifier ALP 44's, 5 , (or other input devices) provide the Timebase PCB with external clocks that can be assigned to control the timing of Pod groups.

**5.3.1.8 Clocks.** There are four clocks, ⑥, available for data synchronization:

- Internal Clock (synchronous)
- External Clock 1(asynchronous)
- External Clock 2(asynchronous)
- External Clock 3(asynchronous)

78343N

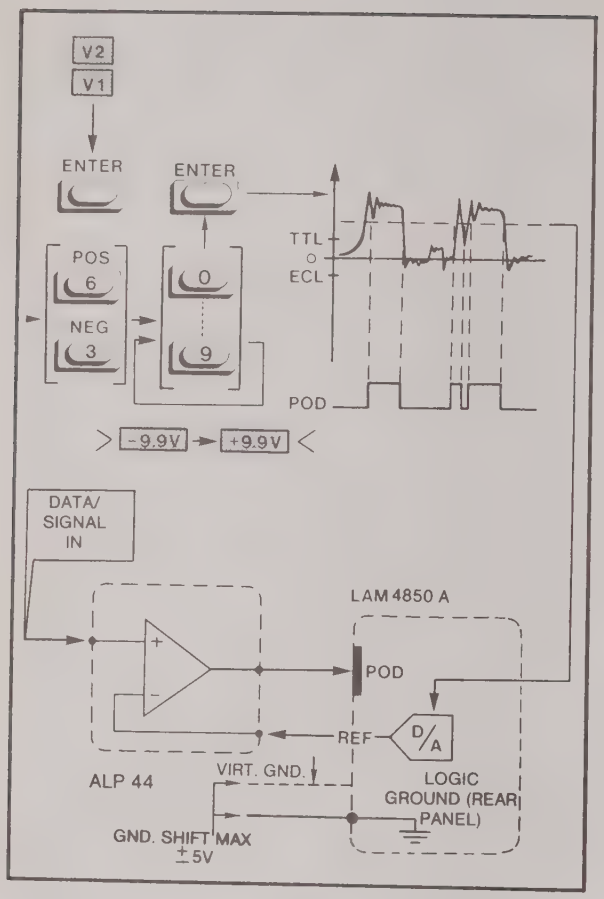



FIGURE 5-13. THRESHOLD ADJUST

5.3.1.9 OR. The External Clocks can be combined in an "OR" function (exactly analogous to a logical OR gate), either with one another or with the Internal Clock. Figure 5-14 shows such an "OR"combination for the External Clocks. The table below lists the "OR" function combinations possible for each pod group. The clock source is programmed individually for each pod group in the CLOCK field heading. Note that when an external clock is applied to input #1 it controls all pod groups unless otherwise specified in the TRACE MENU programming.

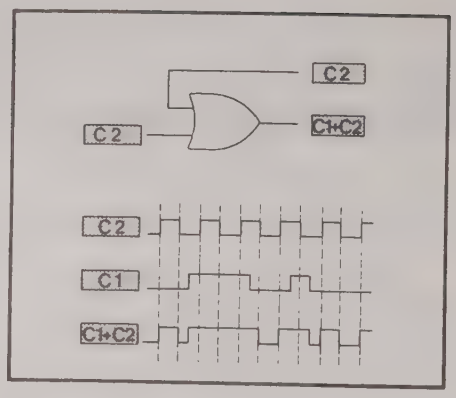



FIGURE 5-14. CLOCK SOURCE PROGRAMMING

| CLOCK SOURCE | POD GROUP | | |
|---|---|---|---|
| | A&B | C&D | E&F |
| INT | X | X | X |
| C 1 | X | X | X |
| C 2 | | X | |
| C 3 | | | X |
| INT+C1 | X | X | X |
| INT+C 2 | | X | |
| INT+C3 | | | X |
| C1 + C2 | X | X | X |

5.3.1.10 For each external clock two other parameters may be controlled:

- Slope (+/-)
- Qualifiers

When a "+" is assigned to an external clock, it is active on the rising edge; a "-" causes it to be active on the falling edge of the pulse. For each External Clock three qualifiers (High, Low, and Don't Care) are programmable. The Threshold level for the qualifier is the same as that assigned for the External Clock in the "CLK LEVEL" field heading.

The Slope and Qualifiers are both associated with the Control Logic Circuitry of the Timebase PCB. Figure 5-15 shows the Clock Slope and Clock Qualifier operation.

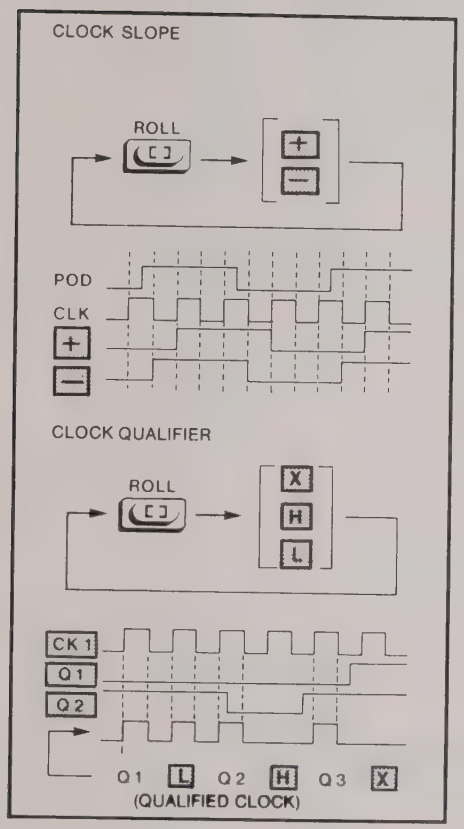



FIGURE 5-15. SLOPE AND QUALIFIERS

78343N

NOTES

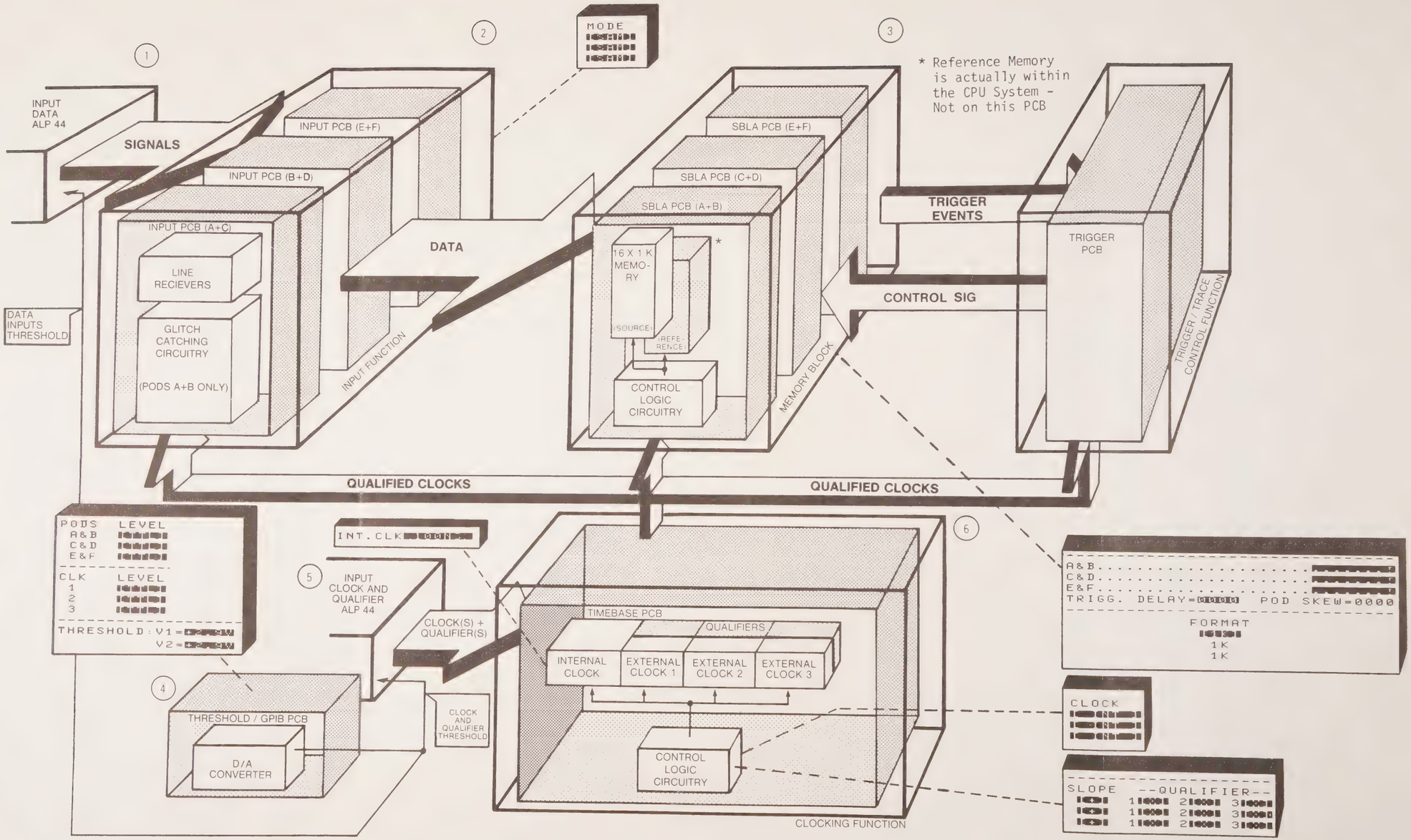



FIGURE 5-7. TRACE MENU FUNCTIONAL BLOCK

### 5.3.2 Trace Menu Operating Procedures

Refer to Figure 5-16 in the following section. Circle numbers in Figure 5-16 correspond to those in Figure 5-17. The TRACE MENU operating procedures are shown in Figure 5-17; a flowchart covering the next pages. Operating procedures are presented in an operator decision-oriented manner. Major decisions correspond to field headings in the TRACE MENU display.

NOTE:

Move Cursor to all fields desired in the TRACE MENU with EDIT Group pushbuttons.

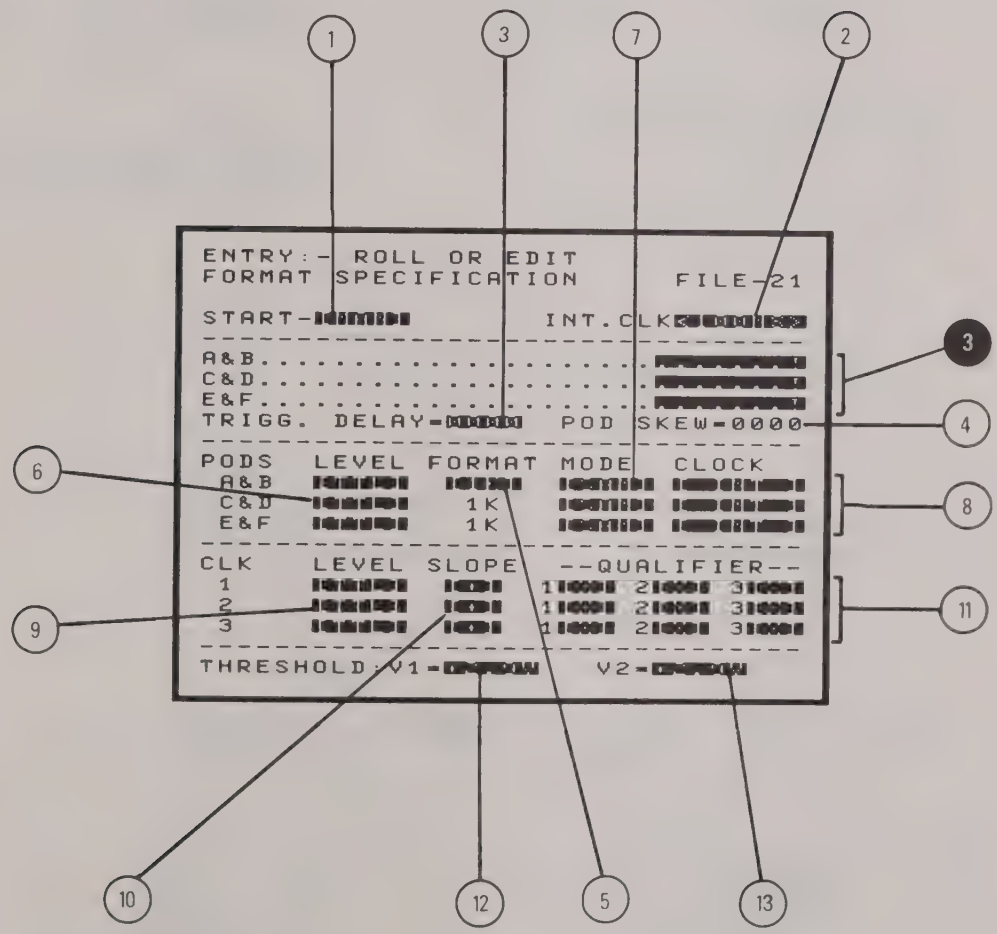



FIGURE 5-16. TRACE MENU KEYS

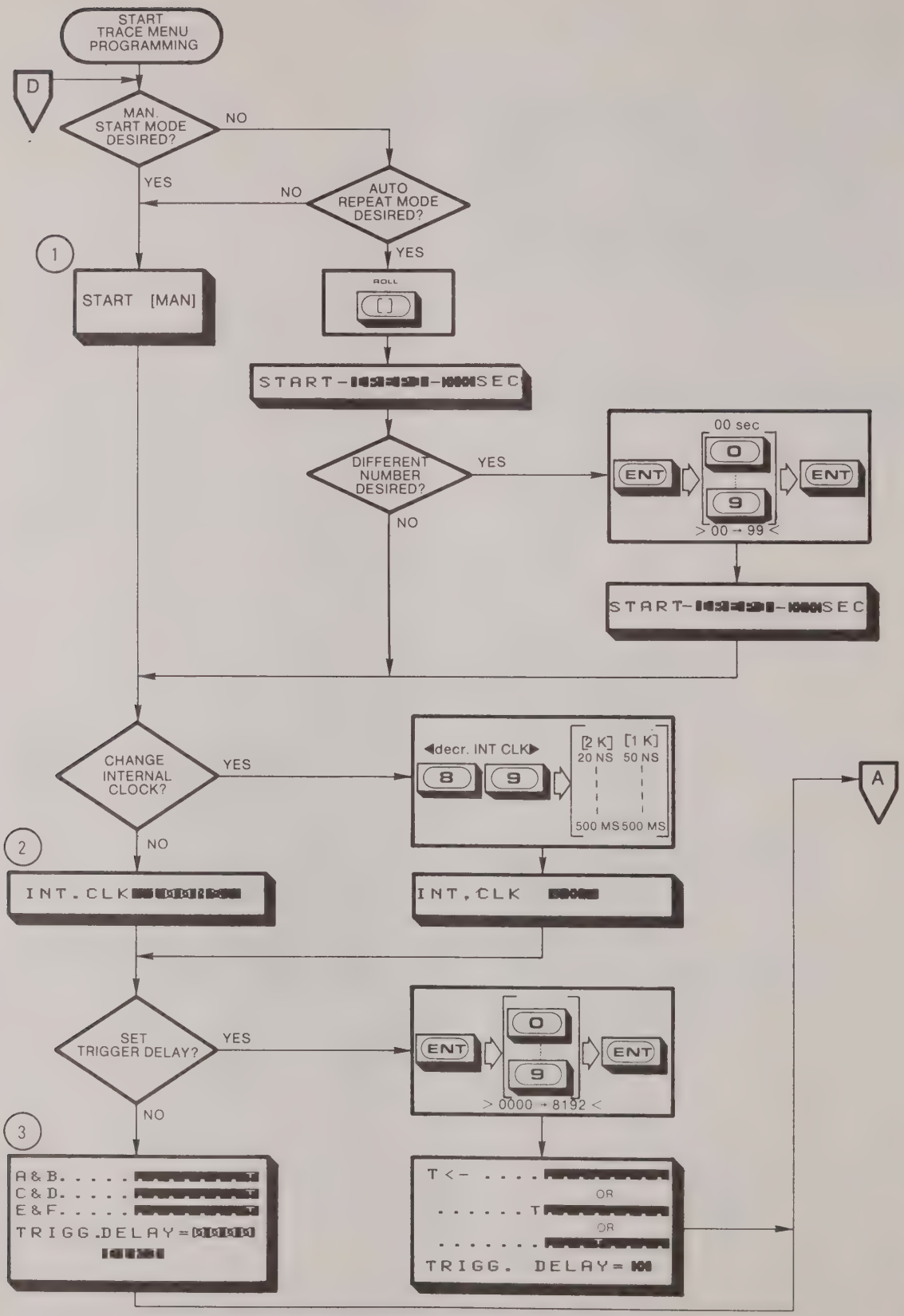



FIGURE 5-17A. TRACE MENU OPERATION

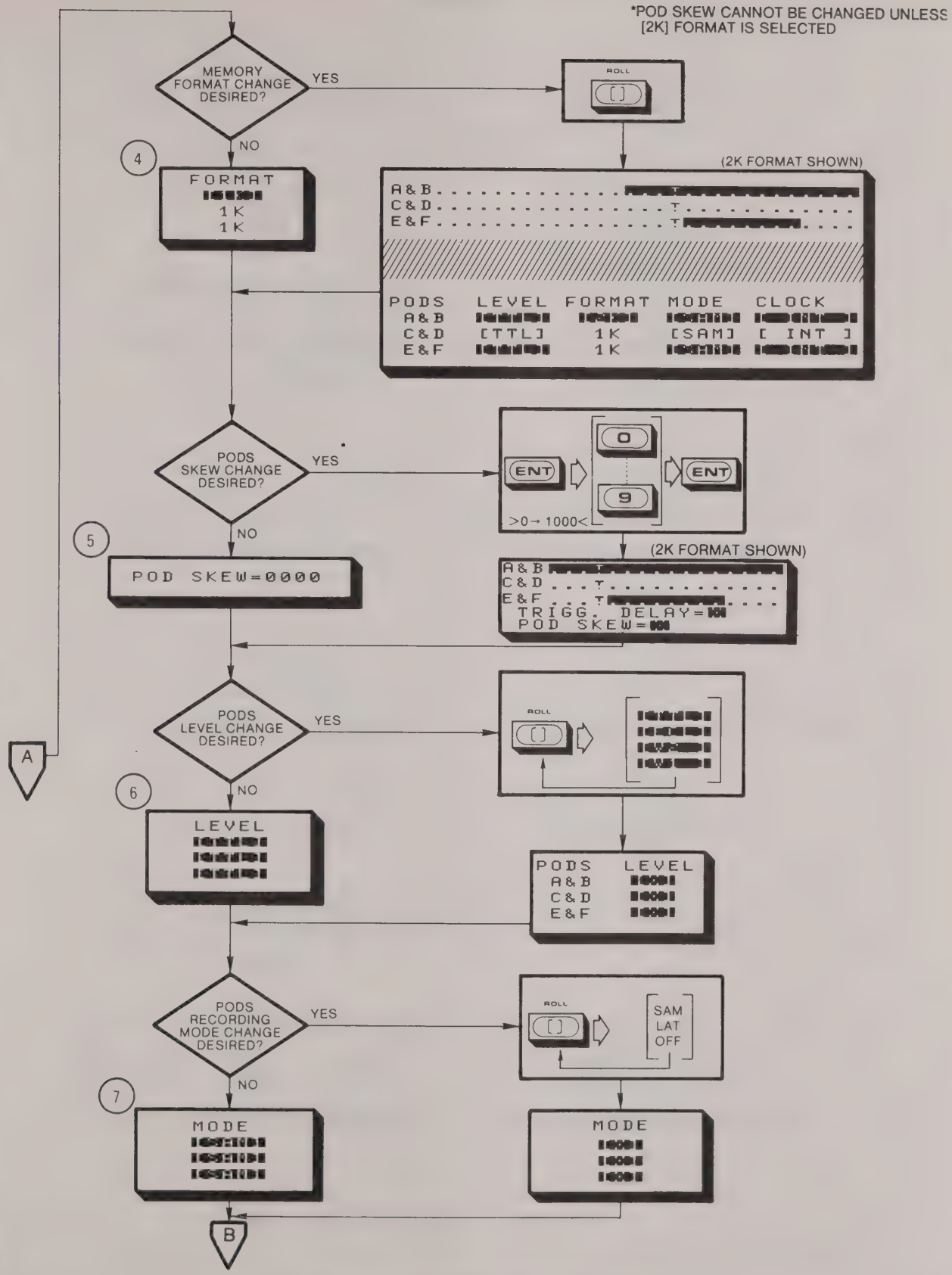
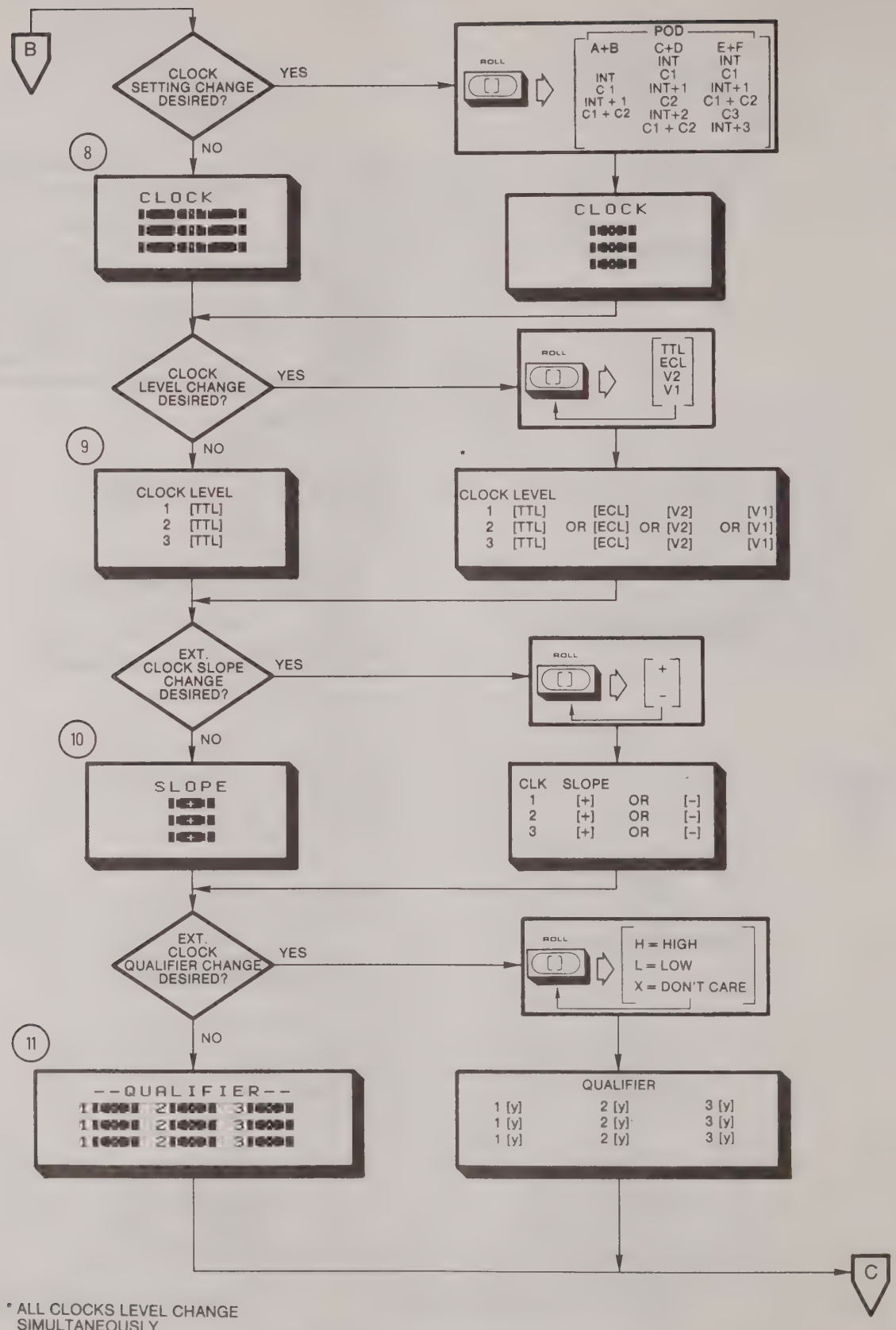



FIGURE 5-17B. TRACE MENU OPERATION




* ALL CLOCKS LEVEL CHANGE SIMULTANEOUSLY

FIGURE 5-17C. TRACE MENU OPERATION

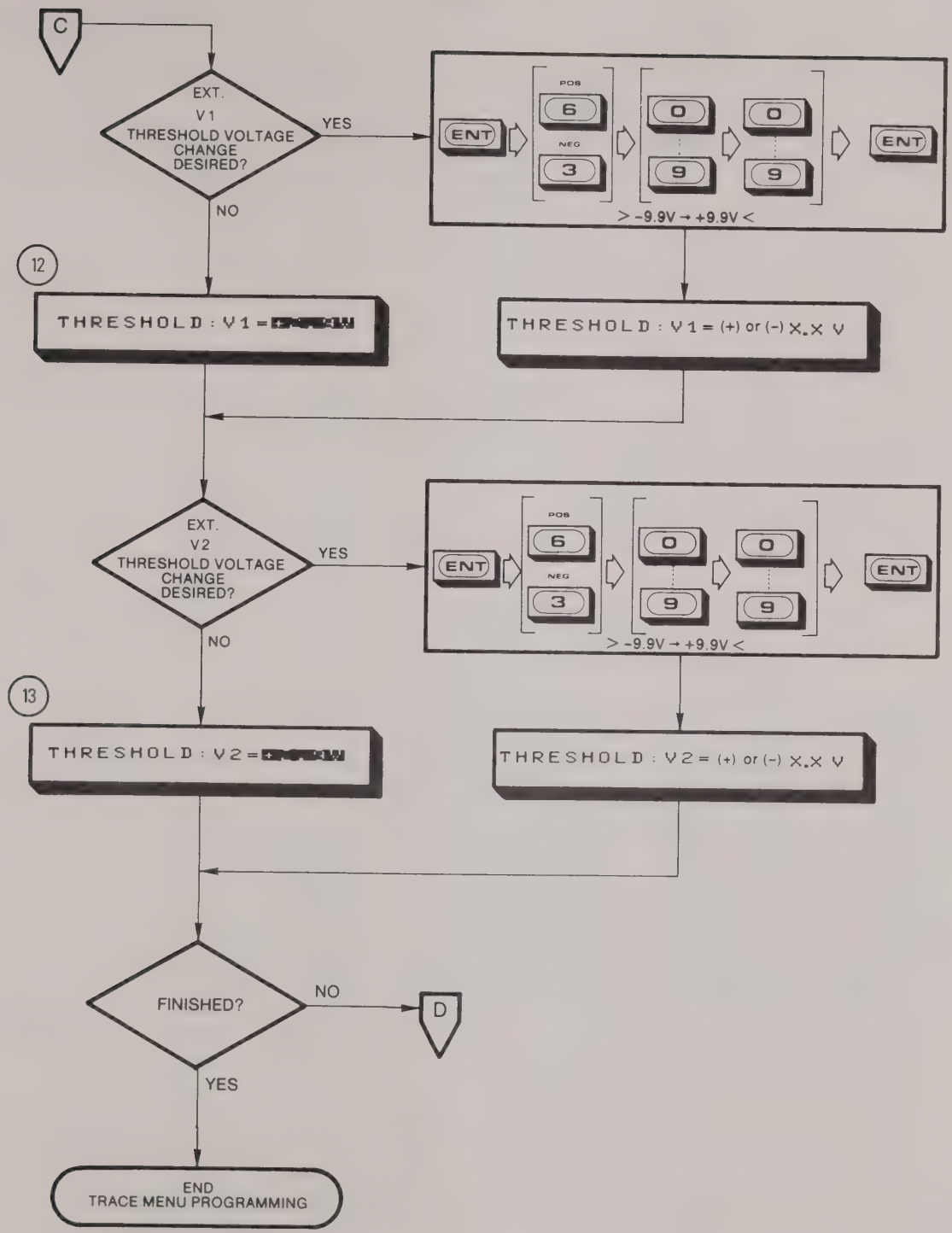



FIGURE 5-17D. TRACE MENU OPERATION

78343N

NOTES

### 5.3.3 Trigger Menu Operational Theory

The best way to understand the TRIGGER MENU is to imagine it as a "net" with which you will trap data. You arrange the data flow through the net with the TRIGGER MENU (Figure 5-18) and design the shape of it with the TRIGGER WORD DEF PAGE (Figure 5-19). The TRIGGER MENU arranges the data flow by providing programmable control over the four sequences of search and the particular functions of levels (3 for each) within those sequences. Table 5-1 describes the TRIGGER MENU functions. The TRIGGER WORD DEF PAGE, which are accessible only when the TRIGGER MENU is displayed, are used to define the actual Trigger words (12 maximum). Note that any one Trigger word may be up to 48 bits wide. The TRIGGER MENU is used to program the general flow of the sequential Trigger Search. At power-up, it is always displayed, preset to the simplest trigger condition:

ADVANCE AFTER 001 CLOCKS

This means that no trigger word at the input to the Logic Analyzer is needed for triggering (FREE RUN condition).

To extend this function the user may activate more sequences by programming the (ON/OFF) fields and by adding further commands to each sequence level selected. To activate the sequences, the EDIT group cursor must be moved through the TRIGGER MENU, where functions (F0) to (F7) can be selected with the "ROLL" pushbutton. The function is explained in brief text.

The Trigger word, which may be part of a function display, is shown as a reference number at the end of the function line. These reference numbers correspond to those selected in the TRIGGER WORD DEFINITION pages, where the Trigger words can be programmed.

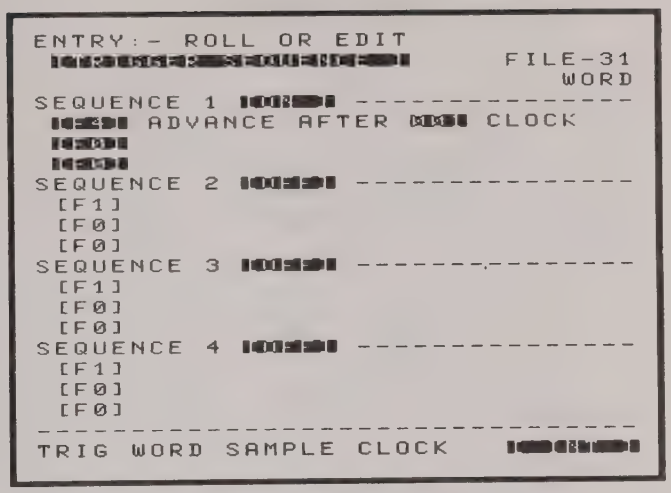



FIGURE 5-18. TRIGGER MENU

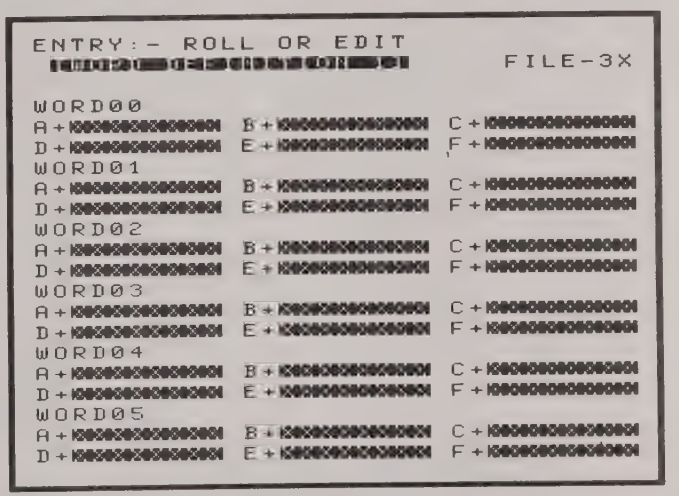



FIGURE 5-19. TRIGGER WORD DEFINITION MENU

TABLE 5-1. TRIGGER MENU FUNCTIONS

| COMMAND/FUNCTION | DESCRIPTION |
|---|---|
| OFF | Used to deactivate all levels within a sequence. When the sequence is turned off, function codes appear in normal, non-inverse video. All other text for levels are erased. |
| ADVANCE AFTER XXX EVENT(s) WORD XX | When the Trigger word XX has been recognized X times (maximum 255), the analyzer will jump to the next level. The Trigger words may occur in any time sequence. |
| ADVANCE IF NEXT (WORD) X | This condition is linked to the previous trigger level. If the word X immediately follows the word in the previous level, the analyzer will jump to the next level. If the word X does not come immediately after the previous word the analyzer will jump to Sequence 1. |
| ADVANCE IF NEXT NOT (WORD) X | This condition is also linked to the previous trigger level. It's function is exactly opposite to that of the ADVANCE IF NEXT WORD command. Only if the word X does not immediately follow the previous level, the analyzer will jump to Sequence 1. |
| ADVANCE AFTER XXX CLOCK(s) | Independent of the Trigger word, a jump will be made to the next level after XXX (maximum 255) clock cycles. |
| OR TRIGGER IF (WORD) X | The analyzer will be triggered immediately if it recognizes word X as long as it searches for the comparison "advance" function. |
| OR GO TO SEQUENCE 1 IF (WORD) XX | This is the "restart" function, which when combined with an "advance" function, will reset the trigger circuitry to Sequence 1. This is done whenever the word X is recognized before an "advance" function appears. |
| AND TRACE DATA IF (WORD)XX | As long as the analyzer trigger circuitry is seeking an ADVANCE, OR TRIGGER IF, or OR GO TO SEQUENCE 1 function, only data that meets the conditions of word X will be clocked in the analyzer's memory. If a jump to another ADVANCE, OR TRIGGER IF, or OR GO TO SEQUENCE 1 is effected, you may select another AND TRACE DATA IF (WORD) XX function in the next level. |
| OR | When selected, the OR function is tied to the previous level function. It then takes the function number assigned to the previous one. The OR function can also be selected if the Trigger word of the previous level can be linked with the word defined in the following level (CURRENT OR level). Note that ADVANCE functions can also be "OR"ed. |

Trigger Menu Operational Notes:

1) When all sequences are ON or all are OFF, and no level functions are selected, the LAM 4850A will be in the "FREE RUN" mode when the "RUN" pushbutton is pressed. The memory is filled without a trigger event.

2) A & B memory cannot be formatted to 2K if the "AND TRACE DATA IF" function is active.

3) If no "AND TRACE DATA IF" function is selected, all data will be stored.

4) While sampling pretrigger data, all incoming data will be qualified with "AND TRACE DATA IF" condition as programmed within trigger sequence 1 until the programmed Trigger word is recognized.

5) When the trigger search is completed (TRIGGER DELAY ACTIVE), data will be qualified with "AND TRACE DATA IF" condition as programmed until the end of recording.

6) Note the following specifications:

   - Trigger Word Recognition - 50 MHz.
   - Advance "dead" time between trigger levels - 100 ns (for Triggering).
   - Maximum data qualification frequency when "TRACE DATA" is selected - 8 MHz, 1K Format only.

### 5.3.4 Trigger Menu Operating Procedures

Figure 5-20 shows the method of programming the TRIGGER MENU. You must advance the cursor with the Keyboard EDIT group controls to the field heading desired and then use the "ROLL" pushbutton to select functions or the clock source. Verify that Trigger Words selected in the TRIGGER MENU are programmed in the respective TRIGGER WORD DEFINITION PAGE.

**5.3.4.1 Trigger Sequence Programming.** When a sequence is turned ON, the three levels of that sequence are available for programming with the "ROLL" pushbutton. With some functions you will have to enter numbers (see Non-Bracketed Input Types, Section 5.2.3 for details) before proceeding to the next sequence or level.

**5.3.4.2 Trigger Menu Sample Clock Programming.** Table 5-2 shows the sample clock sources and their selection order when the cursor is in the "Sample Clock" field (See Figure 5-18, 1 ) and the "ROLL" pushbutton is pressed. Note that the programmed clock source for the TRIGGER MENU Sample must be assigned also to one of the active Pod groups (see TRACE MENU, Section 5.3.1.7). If the "Clock" field is changed in the TRIGGER MENU, the TRACE MENU must also be changed to correspond with the TRIGGER MENU.

TABLE 5-2. SAMPLE CLOCK

| SELECTION | CLOCK SOURCE |
|---|---|
| | INT<br>C1<br>INT+1<br>C2<br>INT+2<br>C1 + C2<br>C3<br>INT+3 |

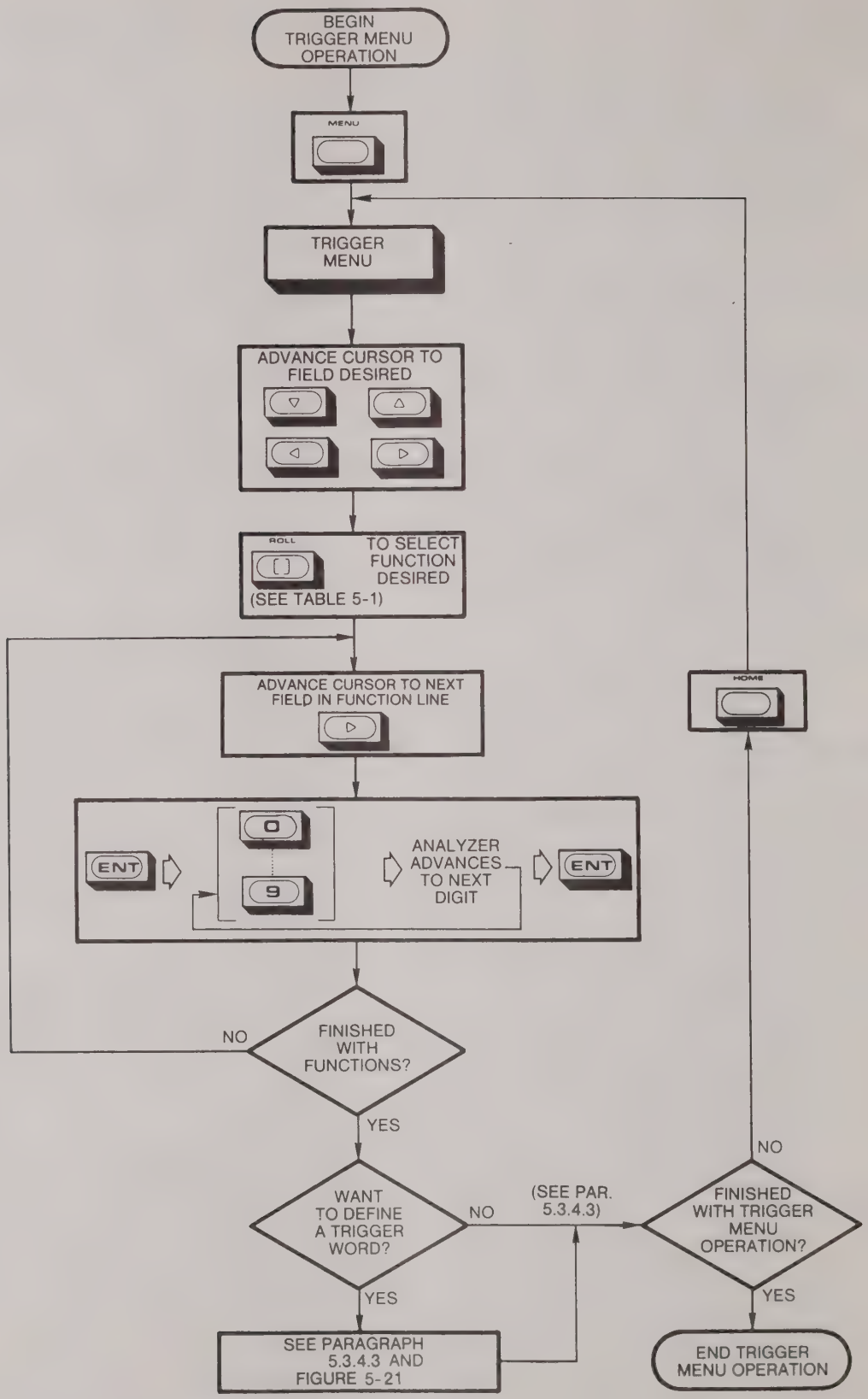



FIGURE 5-20. TRIGGER MENU OPERATION

**5.3.4.3 Trigger Word Definition Operating Procedures.** In order to use the TRIGGER WORD DEF (page 1 or 2), you must first be in the TRIGGER MENU. Press "HOME" to set the cursor to the first field heading and then press the "ROLL" pushbutton to select the TRIGGER WORD DEF page desired. Figure 5-21 shows the Trigger Word Definition operating procedures in flowchart form.

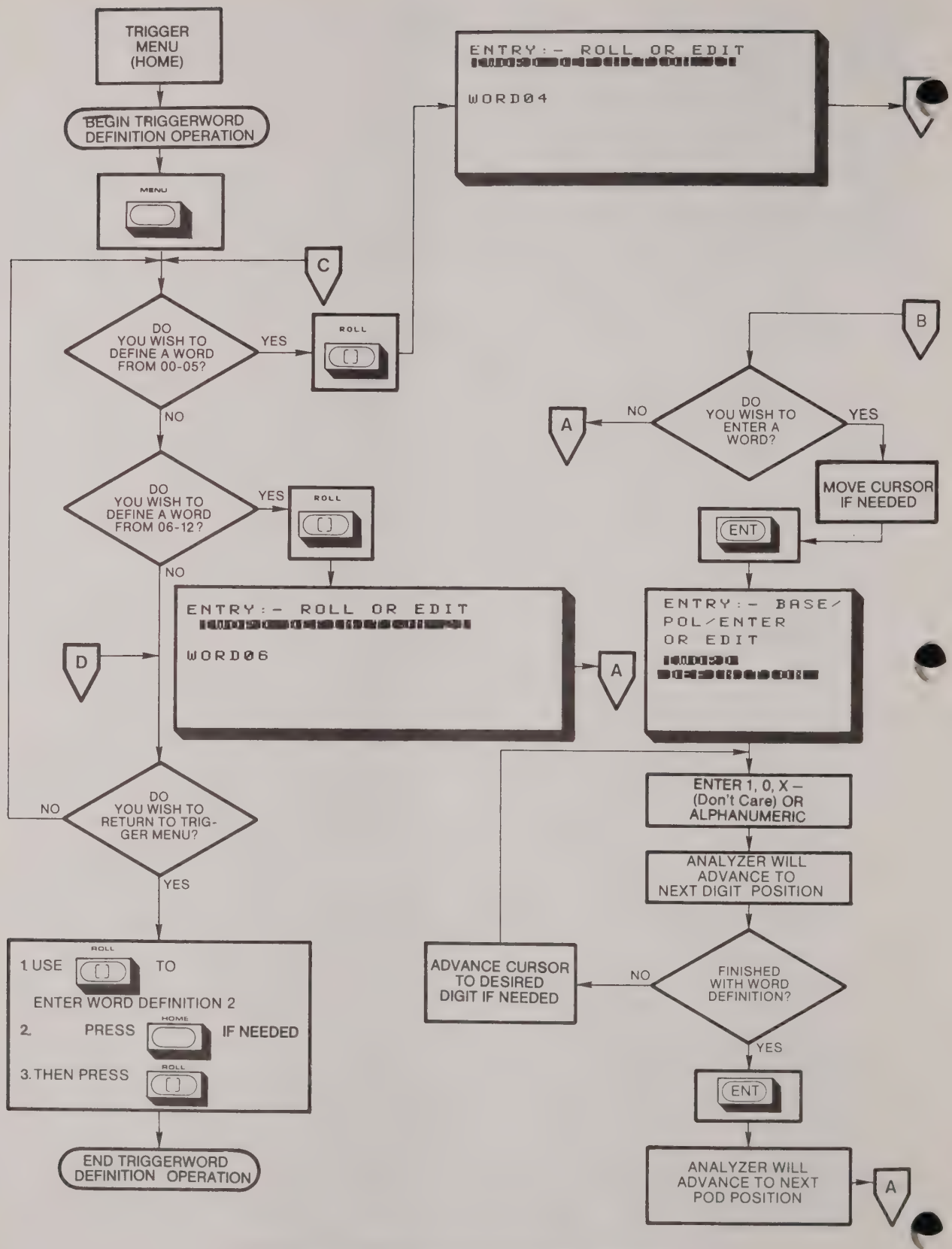



FIGURE 5-21A. TRIGGER WORD DEFINITION MENU OPERATION

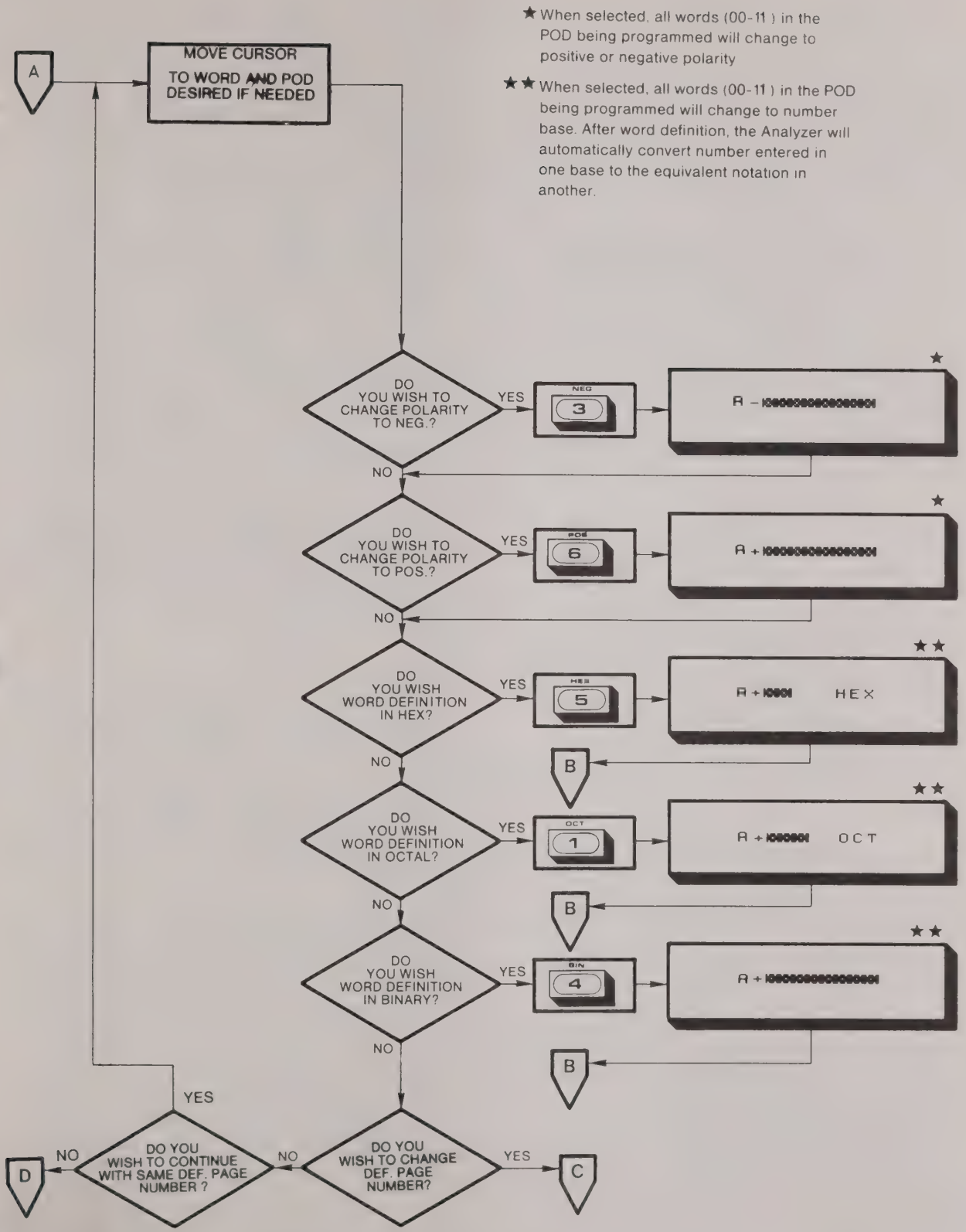

★ When selected, all words (00-11 ) in the POD being programmed will change to positive or negative polarity
★★ When selected, all words (00-11 ) in the POD being programmed will change to number base. After word definition, the Analyzer will automatically convert number entered in one base to the equivalent notation in another.
A
MOVE CURSOR TO WORD AND POD DESIRED IF NEEDED
DO YOU WISH TO CHANGE POLARITY TO NEG.?
YES
NEG
3
NO
DO YOU WISH TO CHANGE POLARITY TO POS.?
POS
6
DO YOU WISH WORD DEFINITION IN HEX?
HEX
5
HEX
DO YOU WISH WORD DEFINITION IN OCTAL?
OCT
1
OCT
DO YOU WISH WORD DEFINITION IN BINARY?
BIN
4
B
DO YOU WISH TO CHANGE DEF. PAGE NUMBER?
DO YOU WISH TO CONTINUE WITH SAME DEF. PAGE NUMBER ?
C
D

FIGURE 5-21B. TRIGGER WORD DEFINITION MENU OPERATION

### 5.3.5 Compare Menu Operation Theory and Procedures

In the following section, the operational theory and procedures for programming the COMPARE MENU are given. The text is keyed to circle numbers in Figure 5-22. The operating procedure for each major field is found in the figures in this section.

The COMPARE MENU allows the user to program parameters for the LAM 4850A automatic comparison function. Comparison is made between previously recorded data (stored in the Reference Memory) and new data (stored in the Source Memory). To compare, a recording must first be made with proper TRIGGER and TRACE MENU parameters. This recording must then be transferred into the Reference Memory. See Section 5.2.3.

When the recorded data is transferred to the Reference Memory the COMPARE MENU may be programmed. The COMPARE MENU is only active when it is displayed on the CRT. To program the COMPARE MENU the user must give the start and end addresses of comparison, number of compare skew, sample number, and set the channels to be compared, as well as how they will be compared (ie., Byte-to-Byte or Bit-to-Bit). In addition, compare conditions (HALT or COUNT, if R= S or R≠S) must be programmed.

Before the comparison is activated, the user may press the "Monitor" pushbutton to verify proper set-up. If an erroneous set-up is programmed and a comparison is attempted, an "INVALID SET-UP" message is displayed. When the "RUN" pushbutton is pressed, "COMPARE PROCESS ACTIVE" is displayed if the COMPARE MENU is properly programmed. The analyzer then starts a recording, filling the Source Memory with new data. When the Source Memory is filled, the recording is stopped. A comparison is then made in accordance to the parameters programmed.

A "dead time" occurs while the comparison is made. During this time all other incoming data are ignored. If the COMPARE MENU parameters programmed are complex, the "dead time" is increased. Once comparison is made the analyzer repeats the record-compare-record process automatically until each memory location between the compare start and end addresses has been examined. Results of the comparison are displayed in the CYCLE COUNTER (which indicates all completed comparisons) and the COND TRUE COUNTER (which indicates the number of times R=S or R≠S). The compare process will be repeated as long as programmed conditions are met or the user manually halts the comparison with the "STOP" pushbutton. When the analyzer is halted, it will return to the COMPARE MENU for further programming.

Source and Reference Memories must be in the same format, must have the same Pod Skew, and the same Pod Groups must be configured per the TRACE MENU. See Figure 5-23 for an illustration of the 1K and 2K Formats.

NOTE:

The cursor is advanced to the desired field headings in this menu with the Keyboard EDIT group pushbuttons.

**5.3.5.1 Range of Compare.** The "START ADDRESS" ① and "END ADDRESS" ② field headings are used to enter the range of memory comparisons. See Figure 5-24 for operating procedures.

**5.3.5.2 Compare Skew.** The "COMPARE SKEW" ③ allows the user to set a tolerance area from 0 to 99 samples before and after each location in the Source Memory. In this area Bit-to-Bit or Byte-to-Byte comparison is made between the Source and Reference Memories, but the chances of a data match are increased in proportion to the skew range defined. Figure 5-25 shows the "COMPARE SKEW" programming procedure.

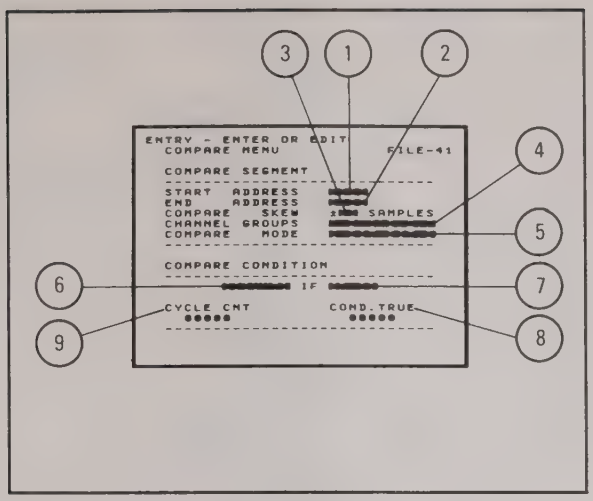



FIGURE 5-22. COMPARE MENU KEYS

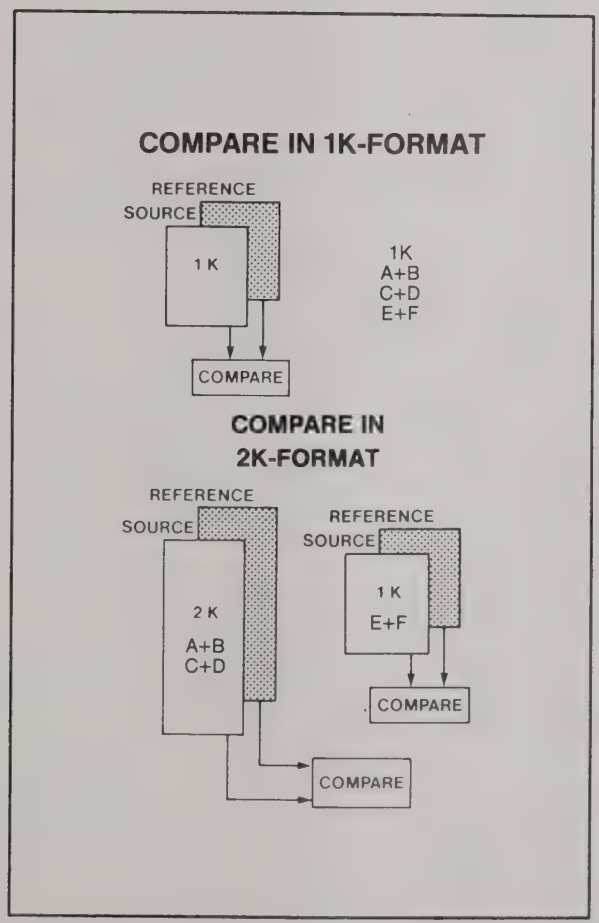



FIGURE 5-23. COMPARE MENU FORMATS

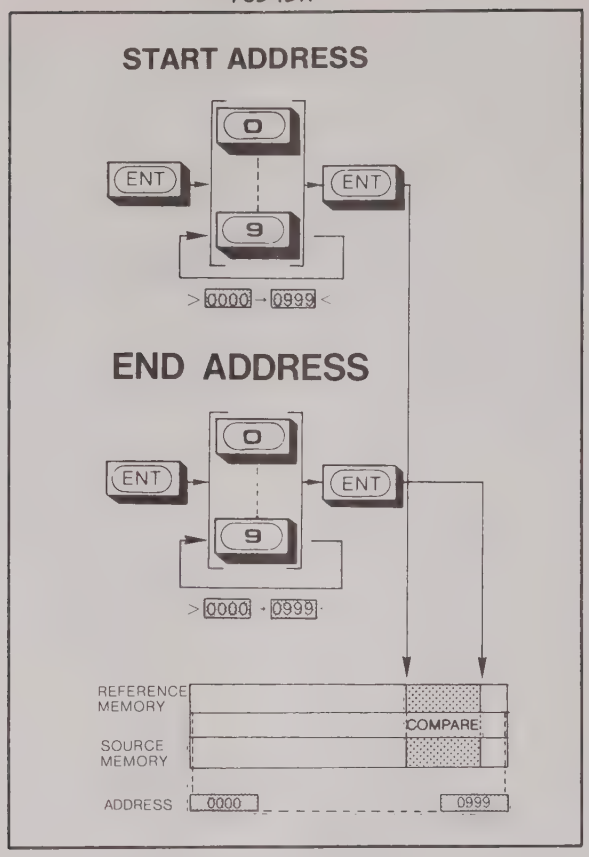



FIGURE 5-24. RANGE OF COMPARE

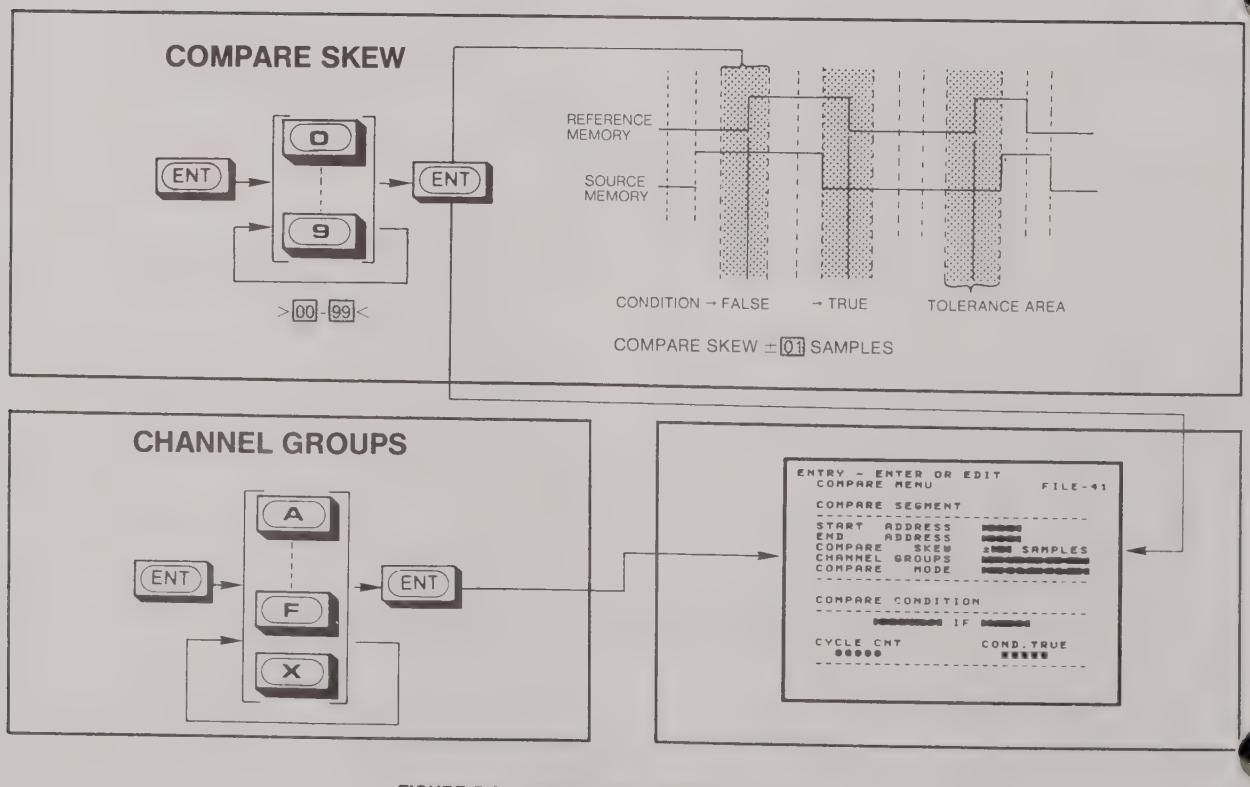



FIGURE 5-25. SKEW AND CHANNEL GROUPS

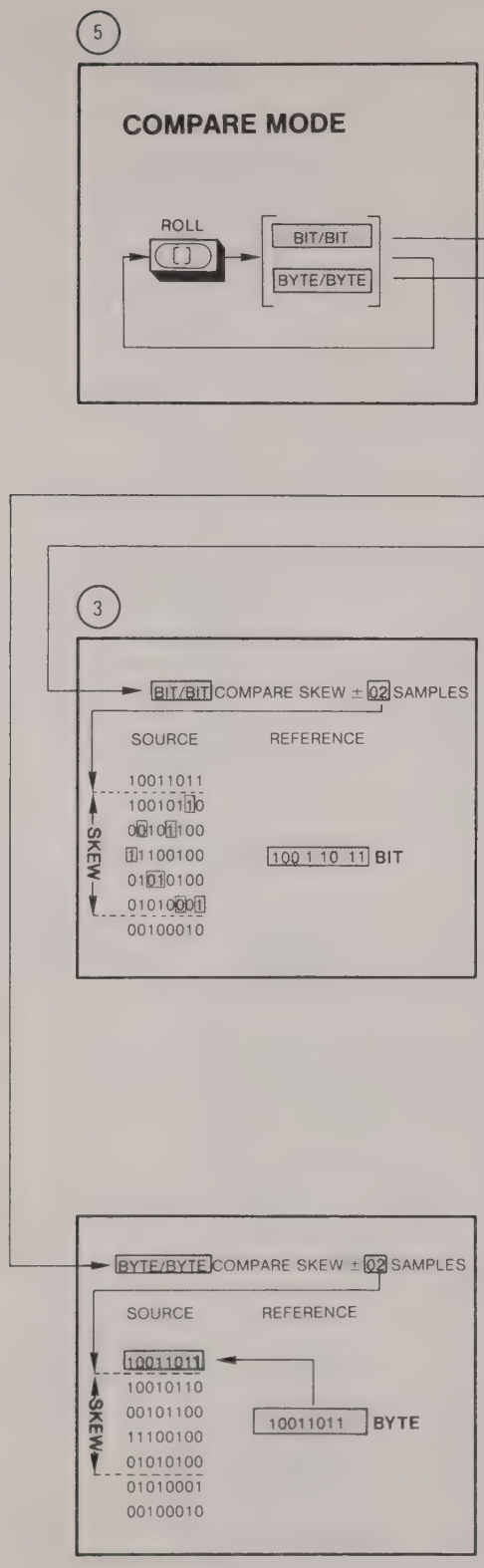



FIGURE 5-26. COMPARE MODES

**5.3.5.3 Channel Groups.** The "CHANNEL GROUP" ④ field heading is used to select the Pod groups which will be active during the compare process. The "X" is used to disable a Pod from comparison. See Figure 5-25.

**5.3.5.4 Compare Mode.** The "COMPARE MODE" ⑤ field heading allows the operator to select either Bit-to-Bit or Byte-to-Byte comparison between the Reference and Source Memories. Figure 5-26 shows these two modes. Operation is dependent on the "COMPARE SKEW" ③ programmed. In Figure 5-26, the compare skew is +/-2 samples of the word in the Reference Memory.

**5.3.5.5 Compare Condition.** In this portion of the COMPARE MENU there are two fields: ⑥ controls the compare process and ⑦ controls the comparison conditions. An explanation of the parameters available in these fields is below.

COUNT ⑥ - If a compare condition is "true", the "CONDITION TRUE" counter, and "CYCLE COUNTER" ⑨, are incremented. The next comparison is made automatically. To stop the LAM in this mode, the "STOP" pushbutton must be pressed.

HALT ⑥ - If a compare condition is "true," the compare process is disabled. The compare process may be manually interrupted by pressing the "STOP" pushbutton.

R = S ⑦ - Specifies that the data of the Reference Memory must be equal to the Source Memory to meet either a "HALT" or "COUNT" compare condition.

R ≠ S ⑦ - Specifies that the data of the Reference Memory must not be equal to the Source Memory to meet either a "HALT" or "COUNT" compare condition.

**5.3.5.6 Compare Counters.** In this portion of the COMPARE MENU there are two fields that only display information: the "CONDITION TRUE" counter, ⑨, and the "CYCLE COUNTER," ⑧, (Figure 5-22). The "CONDITION TRUE" counter displays the number of times a condition has been met. The "CYCLE COUNTER" displays the number of times the comparison has been made.

**5.3.5.7 Overall Operation.** Figure 5-27A shows the overall internal operation of the COMPARE MENU. This figure shows all cases for a "COUNT IF" and "HALT IF" compare condition for both Bit-to-Bit and Byte-to-Byte comparison. Figure 5-27B is a fold-out figure on the next page, which shows the operations keyed to circle numbers in the flowcharts in Figure 5-27A.

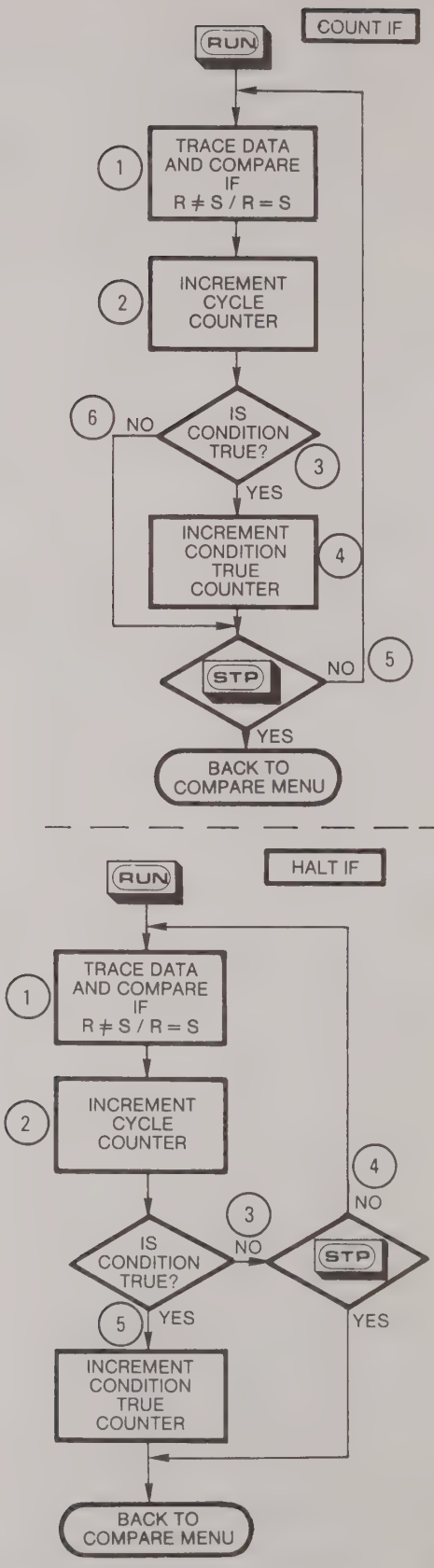
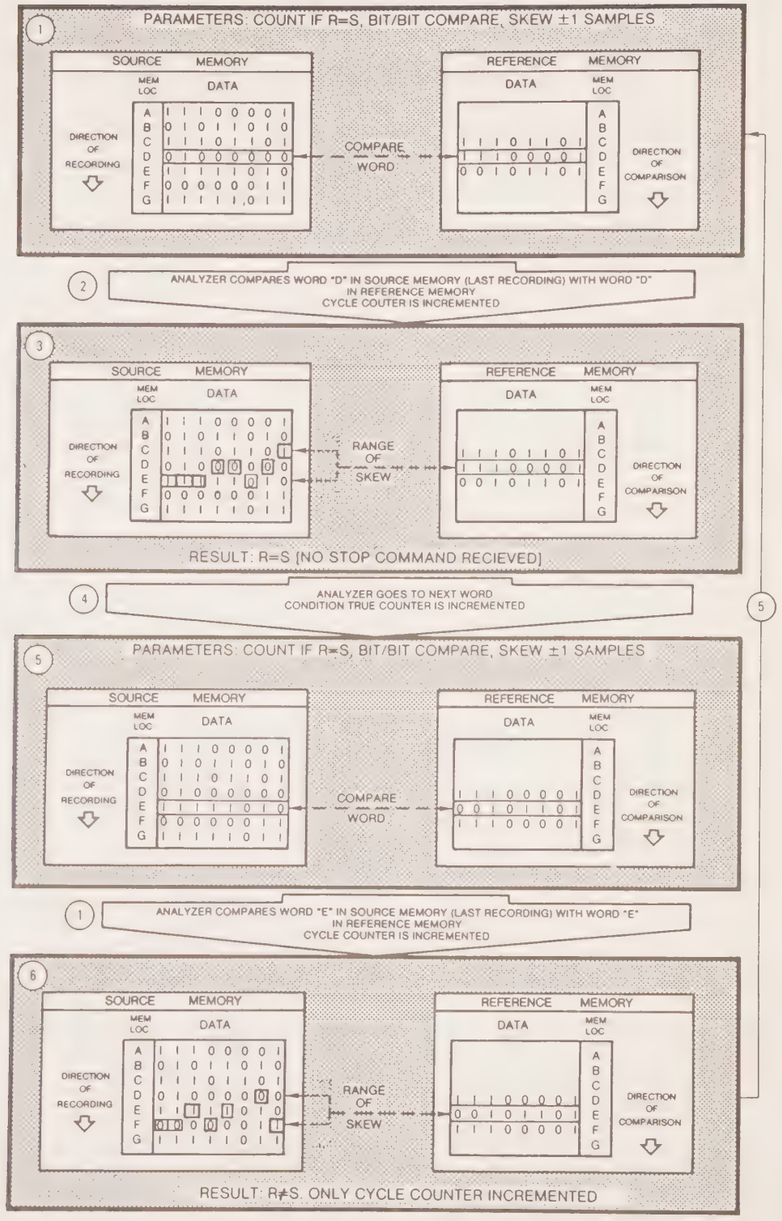



FIGURE 5-27A. COMPARE MENU OPERATION


1
PARAMETERS: COUNT IF R=S, BIT/BIT COMPARE, SKEW ±1 SAMPLES
SOURCE MEMORY
REFERENCE MEMORY
DIRECTION OF RECORDING
COMPARE WORD
DIRECTION OF COMPARISON
2
ANALYZER COMPARES WORD "D" IN SOURCE MEMORY (LAST RECORDING) WITH WORD "D" IN REFERENCE MEMORY
CYCLE COUTER IS INCREMENTED
3
RANGE OF SKEW
RESULT: R=S [NO STOP COMMAND RECIEVED]
4
ANALYZER GOES TO NEXT WORD
CONDITION TRUE COUNTER IS INCREMENTED
5
PARAMETERS: COUNT IF R=S, BIT/BIT COMPARE, SKEW ±1 SAMPLES
1
ANALYZER COMPARES WORD "E" IN SOURCE MEMORY (LAST RECORDING) WITH WORD "E" IN REFERENCE MEMORY
CYCLE COUNTER IS INCREMENTED
6
RESULT: R≠S. ONLY CYCLE COUNTER INCREMENTED

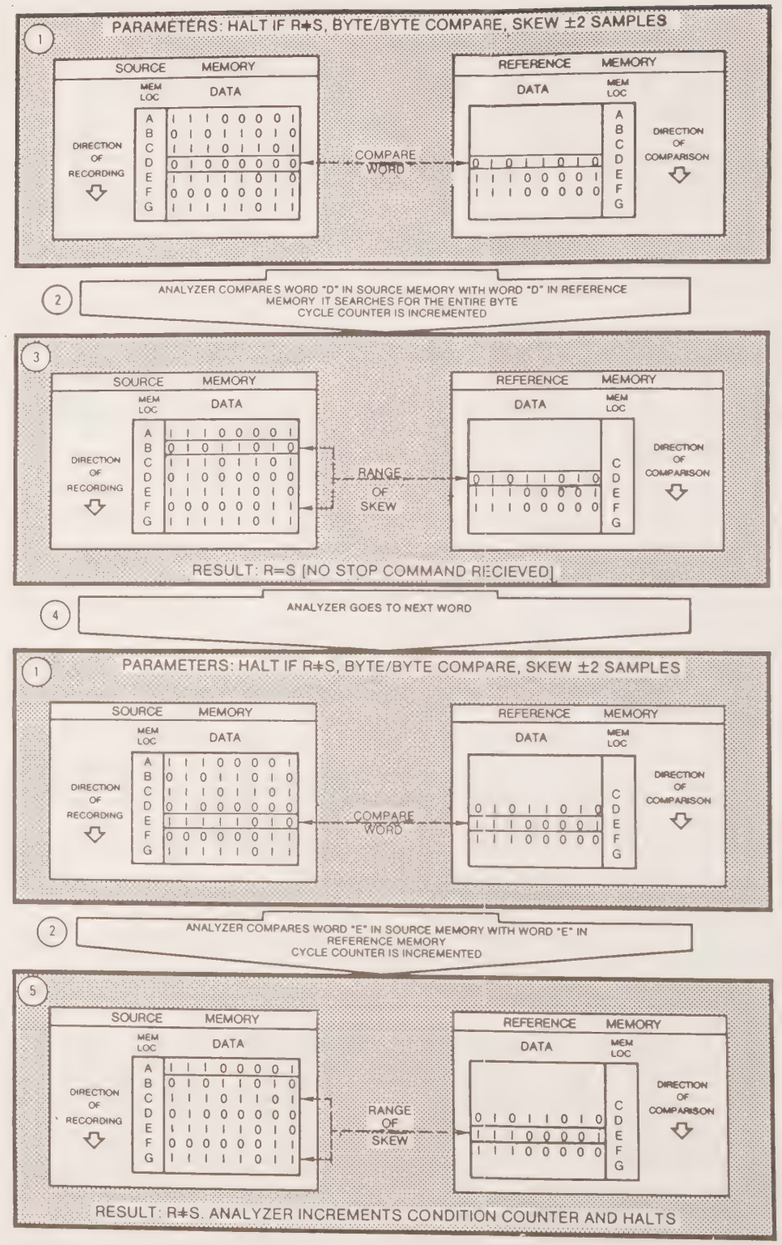

1
PARAMETERS: HALT IF R≠S, BYTE/BYTE COMPARE, SKEW ±2 SAMPLES
SOURCE MEMORY
REFERENCE MEMORY
DIRECTION OF RECORDING
COMPARE WORD
DIRECTION OF COMPARISON
2
ANALYZER COMPARES WORD "D" IN SOURCE MEMORY WITH WORD "D" IN REFERENCE MEMORY IT SEARCHES FOR THE ENTIRE BYTE
CYCLE COUNTER IS INCREMENTED
3
RANGE OF SKEW
RESULT: R=S [NO STOP COMMAND RECIEVED]
4
ANALYZER GOES TO NEXT WORD
1
PARAMETERS: HALT IF R≠S, BYTE/BYTE COMPARE, SKEW ±2 SAMPLES
2
ANALYZER COMPARES WORD "E" IN SOURCE MEMORY WITH WORD "E" IN REFERENCE MEMORY
CYCLE COUNTER IS INCREMENTED
5
RESULT: R≠S. ANALYZER INCREMENTS CONDITION COUNTER AND HALTS

FIGURE 5-27B. COMPARE MENU OPERATION

### 5.3.6 Option Table Operation

The OPTION TABLE is a display that shows which options are available for the LAM 4850A being used. The operation is straight-forward, as shown in Figure 5-28. Option selections are made only when the LAM is not in the recording mode. To select options proceed as follows:

1) Use the "MENU" pushbutton to access the OPTION TABLE.

2) Move the cursor to the desired option using the keyboard "EDIT" group pushbuttons .

3) Press the "OPTION" pushbutton. The optional menu selected will appear on the CRT.

4) Any time the "OPTION" pushbutton is pressed, it will cause the menu selected to appear (or the function to activate). If you want to change the option, repeat steps 1 through 3 above.

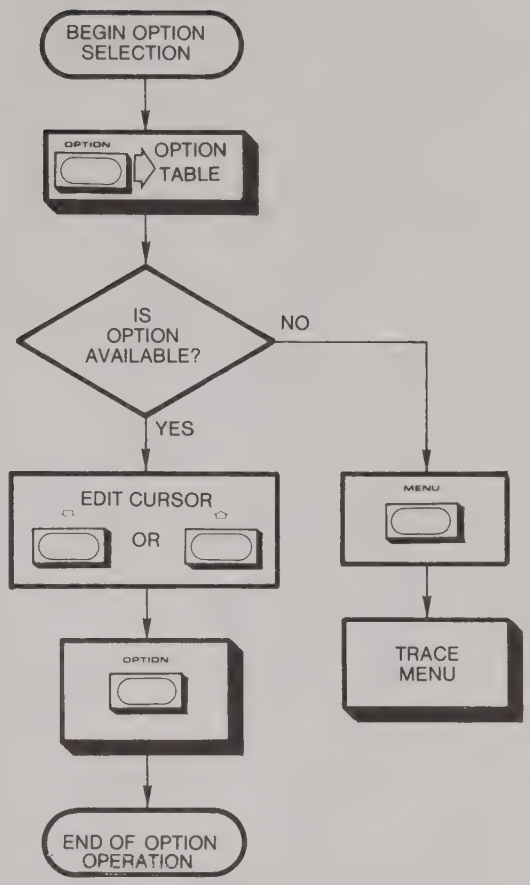



FIGURE 5-28. OPTION SELECTION

### 5.3.7 Set-Up Monitor

The SET UP MONITOR is used primarily during the Pre-Record Programming Mode to aid the user in setting up recording parameters. During this mode, any time the "MONITOR" pushbutton is pressed the internal software tests the combination of programmed parameters and sends a message to the CRT. This message is in one of two forms: either that the set-up is correct (VALID SETUP!), along with a summary of the parameters programmed, or that the set-up is wrong (SETUP CHECK RESULTS), along with the reasons why.

Note that the Set-up Monitor function is automatically present whenever a recording is made. When the programmed set-up is correct, and the user begins a recording, the Set-up Monitor operation is transparent. If, however, there is something wrong with programmed parameters the "SETUP CHECK RESULTS" monitor is displayed and the recording is disabled until those parameters identified are changed.

## 5.4 DATA RECORDING MODE

Once the recording parameters have been inputed and the "RUN" pushbutton has been pressed, the Data Recording Mode operation is completely internal. The recording is stopped either automatically or by the user pressing the "STOP" pushbutton. It is not possible to change parameters that have been preprogrammed. The user may only monitor a recording in progress. Thus, the Data Recording Mode operation is as follows:

- Begin Recording
- Monitor Recording
- End Recording

### 5.4.1 Trace/Trigger Monitor Operation

The TRACE/TRIGGER MONITOR provides the only way to monitor what the LAM is doing during a recording. This may be done if it is known that the recording will take some time or if it is suspected that too much time is being taken. Usually, recordings are done too quickly for the monitor to be effective. Figure 5-29 shows the TRACE/TRIGGER MONITOR operation. Circle numbers are keyed to the following notes that explain how to interpret the monitor display.

① "SLOW CLOCK ON: "X+X"-This message has two meanings: there is really no clock or a very slow clock (less than 20 ms) is active. If the "SLOW CLOCK ON:" message is blinking off and on, it indicates the moments when the source clock edge is active. If the message remains on, there is a problem with the clock source(s).

② "PRETRIGGER SAMPLING"-The blinking space in these bar graphs indicates that the pretrigger sampling phase is active.

③ Trigger Sequence Display - In this field the TRIGGER MENU functions are displayed to remind the user of the Trigger configurations programmed. This is displayed only during a Pre-Trigger Sampling phase.

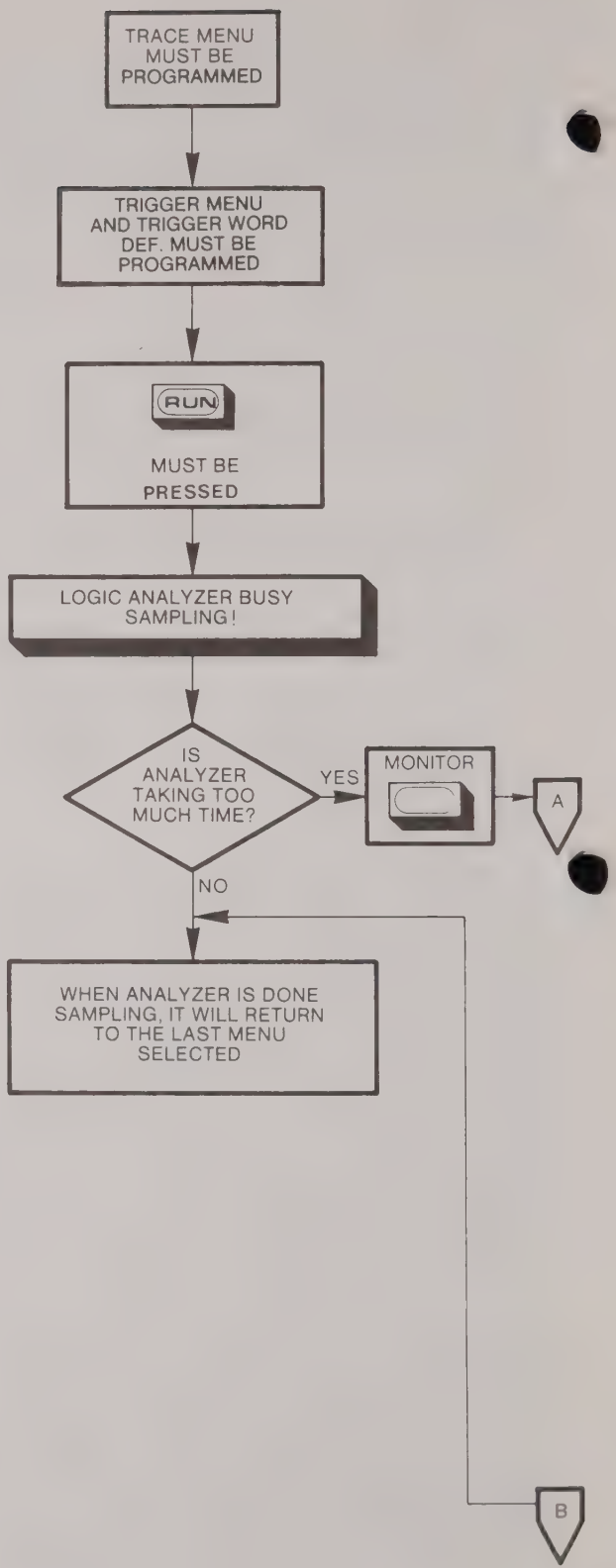
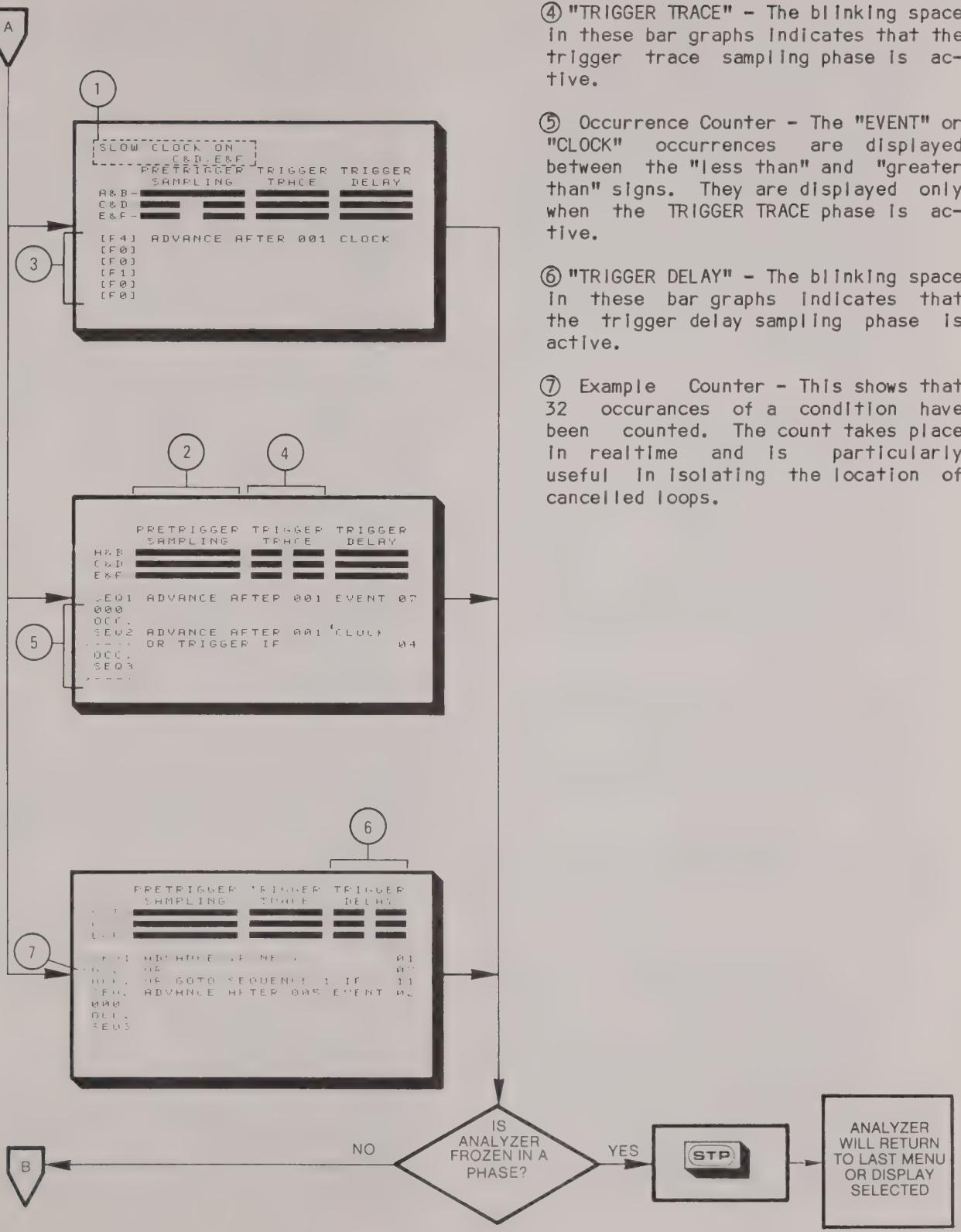



FIGURE 5-29A. TRACE / TRIGGER MENU OPERATION




④ "TRIGGER TRACE" - The blinking space in these bar graphs indicates that the trigger trace sampling phase is active.

⑤ Occurrence Counter - The "EVENT" or "CLOCK" occurrences are displayed between the "less than" and "greater than" signs. They are displayed only when the TRIGGER TRACE phase is active.

⑥ "TRIGGER DELAY" - The blinking space in these bar graphs indicates that the trigger delay sampling phase is active.

⑦ Example Counter - This shows that 32 occurances of a condition have been counted. The count takes place in realtime and is particularly useful in isolating the location of cancelled loops.

FIGURE 5-29B. TRACE / TRIGGER MENU OPERATION

## 5.5 DATA ANALYSIS MODE

The Data Analysis Mode allows for powerful analysis functions of recorded data by use of the TIMING DIAGRAM, LIST DISPLAY, and other optional features that may be combined with these. Many of the TIMING modes, interpretation aspects, and operating procedures are the same as those for the LIST DISPLAY. In fact, it is possible to transfer from one to the other and observe the analogous positions of the Trigger Point, Set Point, Cursor positions, etc. They both work with the same memory contents at the same time.

The true flexibility of analysis capabilities of the LAM 4850A is evident by the fact that the analysis functions of the TIMING and LIST displays can be operated independently of one another. As an example, the user may use the TIMING DIAGRAM to indicate unequal conditions between the Source and the Reference memories, while at the same time conducting complex programmed search routines for specific word sequence with the LIST DISPLAY.

The major difference between them is that the LIST DISPLAY shows data on each line channel in numeric form (depending on the number base selected), while the TIMING DIAGRAM offers the same information in graphic form.

Detailed interpretation instructions and specific operating procedures are provided in this section for the following:

- Timing Diagram Analysis
- Timing Diagram Memory Functions
- Timing Diagram Search Functions and Interpretation
- List Display Analysis
- List Display Memory Functions
- List Display Search Functions and Interpretation
- Options

### 5.5.1 Timing Diagram Analysis

The TIMING DIAGRAM primarily displays the logic states of all channels recorded. It also shows other forms of data and provides control over the analyzer memory and search functions. These are covered in separate sections under their respective titles. Refer to Figure 5-30 in the following explanations of the TIMING DIAGRAM. Figure 5-30 shows the TIMING DIAGRAM in the 1K Format only. Circle numbers and letters in the figure are keyed to the text in this section as well as the small TIMING DIAGRAM in the Figure. The TIMING DIAGRAM provides these controls:

- Selection of Pod groups to be displayed
- Selecting magnification
- Moving the magnified display
- Making time measurements
- Arranging channels
- Reprogramming Clock(s) Source
- Controlling memory
- Search functions

**5.5.1.1 Pod Group Selection.** Pod group selection is done with the "SELECT" pushbutton, ③ . In the 1K mode, those Pod groups set to OFF (TRACE MENU) are skipped. In the 2K mode, selection of Pod groups A + B or E + F are also done with the "SELECT" pushbutton. However, all data for Pod groups A + B is presented (in X1 magnification) on the full width of the CRT. If Pod groups E + F are selected, the data will appear to be magnified in relation to Pods A + B.

Check the POD SKEW field in the TRACE MENU to see how many memory locations have been shifted. Depending on the present cursor position, in conjunction with the Pod Skew, the cursor may change position in the E + F Pod group display (it may even disappear). Notice that the cursor position numeric

value, Ⓓ, doesn't change. The same display considerations should be made for the possible difference in appearance of the "SET/CURSOR" position.

**5.5.1.2 Selecting Magnification.** The TIMING DIAGRAM information may be expanded for a more detailed view of recorded data by pressing the "TMG/MAG" pushbutton, ④. The display of the Pod groups presently selected will be magnified by factors shown in the "MAG=" field heading, Ⓒ. In the 1K Format, Magnification is X1, X5, and X10. In the 2K Format, it is X1, X10. and X20. Note that when the first and second levels of magnification are selected, the display shows all data, Ⓙ, to the right of the cursor, Ⓓ (including the Set Point).

**5.5.1.3 Moving the Magnified Display.** When any Pod group display is magnified, the cursor is fixed at the left side of the monitor. As further magnification is selected, Ⓚ, the data takes more room on the CRT. Certain elements of the display may momentarily disappear. It is possible to move the data "window," to either the left or right of the display. Pushbutton ⑤ is used to move the window to the left, and pushbutton ⑥ is used to move it to the right. Notice that the Cursor Position numbers, Ⓓ, Cursor Set Point numbers, Ⓕ, and Binaray Information field, Ⓗ, also change with respect to Cursor movement.

**5.5.1.4 Making Time Measurements** The evenly spaced dotted lines, Ⓝ, show 100 memory locations in the 1K Format and 200 memory locations in the 2K Format. These are shown as 16 vertical dots, forming 10 rows across the screen. These may be used for quick approximation of memory (time). To make detailed time measurements of a desired area of the display, several methods are available. In field heading, Ⓓ, a time value based upon the sample clock of the recording is shown.

The memory location difference, Ⓖ, between the cursor's present position, Ⓓ, and a selectable Cursor Set Point, Ⓕ, is shown in relation to the sample clock. This reveals the actual amount of time between the two locations. If the recording was taken by an external clock, the difference is presented as the number of samples (memory locations). Note that time (sample) measurement works in both directions from the Cursor "Set" point. Letter Ⓓ shows a negative measurement and Ⓔ shows a positive measurement.

The normal procedure for making logic measurements is to select an area of interest on the display. This is usually at a change of logic state from high to low or low to high. Use the Binary Information field, Ⓗ, to help find a change if it is difficult to see on the display. Proceed as follows:

1) Position the Cursor, either by pressing the "CURSOR" pushbutton (CURSOR group) or by directly entering the desired location.

2) Press the "SET" pushbutton to fix the "Set Point".

3) Position the Cursor again to either before or after the set point, by using the "CURSOR" pushbutton or by direct location.

The difference between the set point and the new cursor position is presented as a half tone inverse video field (shading).

**5.5.1.5 Arranging Channels.** It is sometimes helpful to view the TIMING DIAGRAM in a way that is not normally presented. For instance, the user may wish to view line channel A3 with B5 immediately under it, delete an entire group of unimportant channels, or rename a previously changed line channel. Figure 5-31 shows the procedures to be used when changing the channels displayed. The following functions are available:

- Delete a line
- Reassign a Pod Number
- Change (swap) Pods
- Recall functions

**5.5.1.6 Reprogramming The Clock(s) Source.** In the TIMING DIAGRAM it is possible to change two trace parameters which are usually programmed in the TRACE MENU:

1) The internal Clock sample rate
2) The clock source for recording

You do not need to advance the cursor to the "CLK" field heading, Ⓞ . Simply use the "ROLL" pushbutton to select the desired clock. Enter the internal Clock sample rate with the "DEC" and "INC" pushbuttons. The TRACE MENU is automatically changed as well. When a recording is desired, press the "RUN" pushbutton. The new recording results are displayed in the TIMING DIAGRAM and the "CLK" field stops blinking.

### 5.5.2 Timing Diagram Memory Functions

In the TIMING DIAGRAM, it is possible to display the contents of the Source Memory (SRC), an OR function of both the Source and Reference Memories (S + R), and to transfer the present Source Memory contents to the Reference Memory (S -> R). Figure 5-32 shows how these functions are selected.

**5.5.2.1 SRC.** When the TIMING DIAGRAM is initially selected, it shows the Source Memory contents. Binary information on the logic states for all channels at the current cursor position is shown at the bottom of the display (See Figure 5-31, Ⓗ ).

**5.5.2.2 S + R.** When the "MEM-select" pushbutton is pressed the first time, the "S + R" function is shown on the "MEM" field of the display. Pressing the "EXECUTE" pushbutton causes data of the Source Memory to be shown on the display but with an OR indication of every location corresponding to the Reference memory. If there is a difference of data at the corresponding locations, these positions are highlighted in inverse video, as shown in the Binary Information field of the display. This function can be thought of as an "overlay" of two color transparencies.

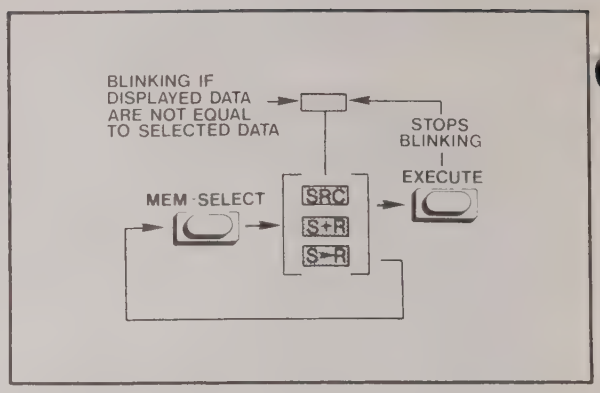



FIGURE 5-32. TIMING DIAGRAM MEMORY SELECTION

**5.5.2.3 S -> R.** When the "MEM-select" pushbutton is pressed a second time, the "S -> R" function is shown in the "MEM" field of the display. Pressing the "EXECUTE" pushbutton causes the analyzer to transfer data from the present Source Memory to the Reference Memory. All previous Reference Memory information is lost, and it is replaced by the new or actual Source Memory. A new recording (Source) can now be done, and a comparison between the old Source (now Reference) and the new Source data can be made.

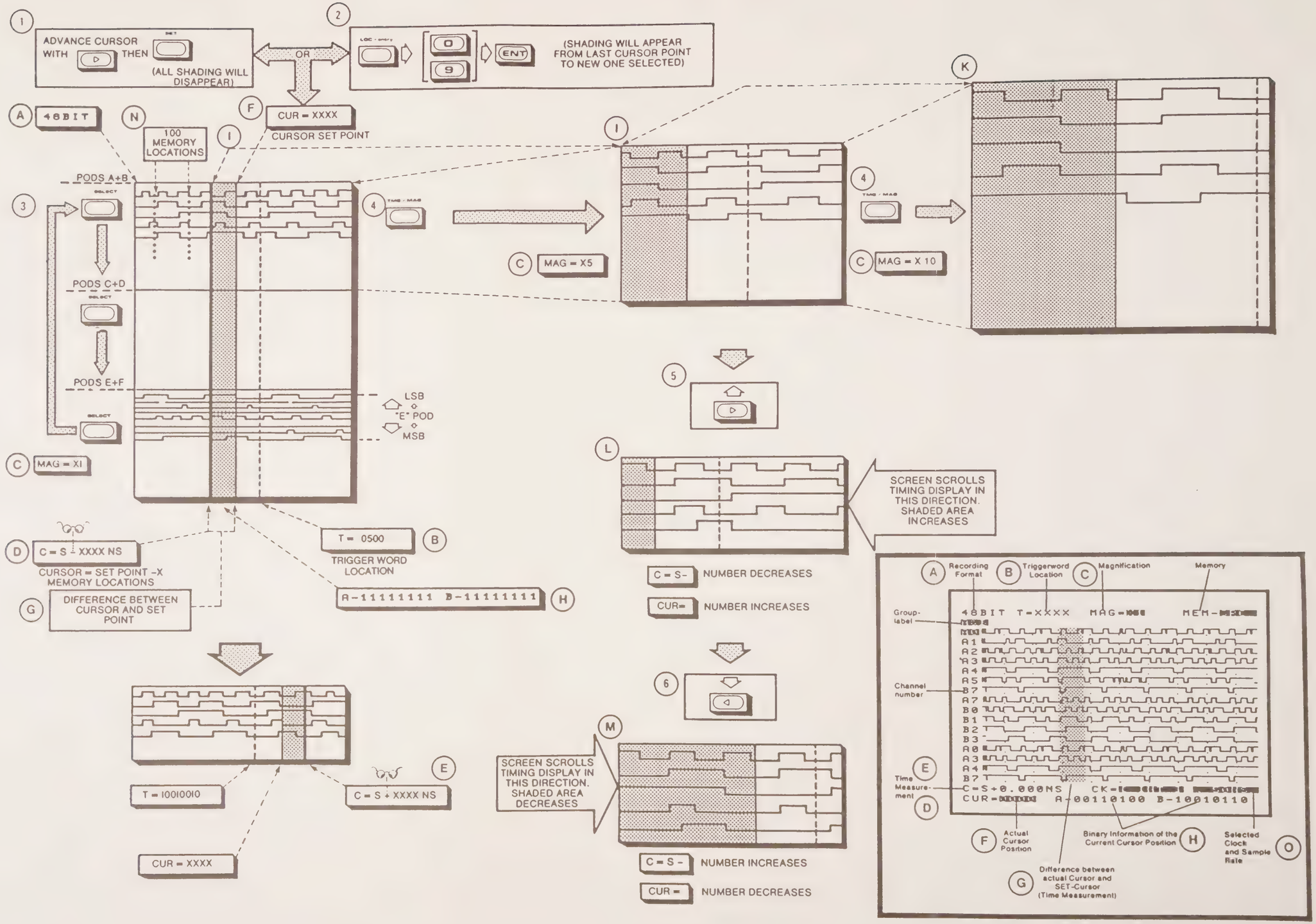



FIGURE 5-30. TIMING DIAGRAM ELEMENTS

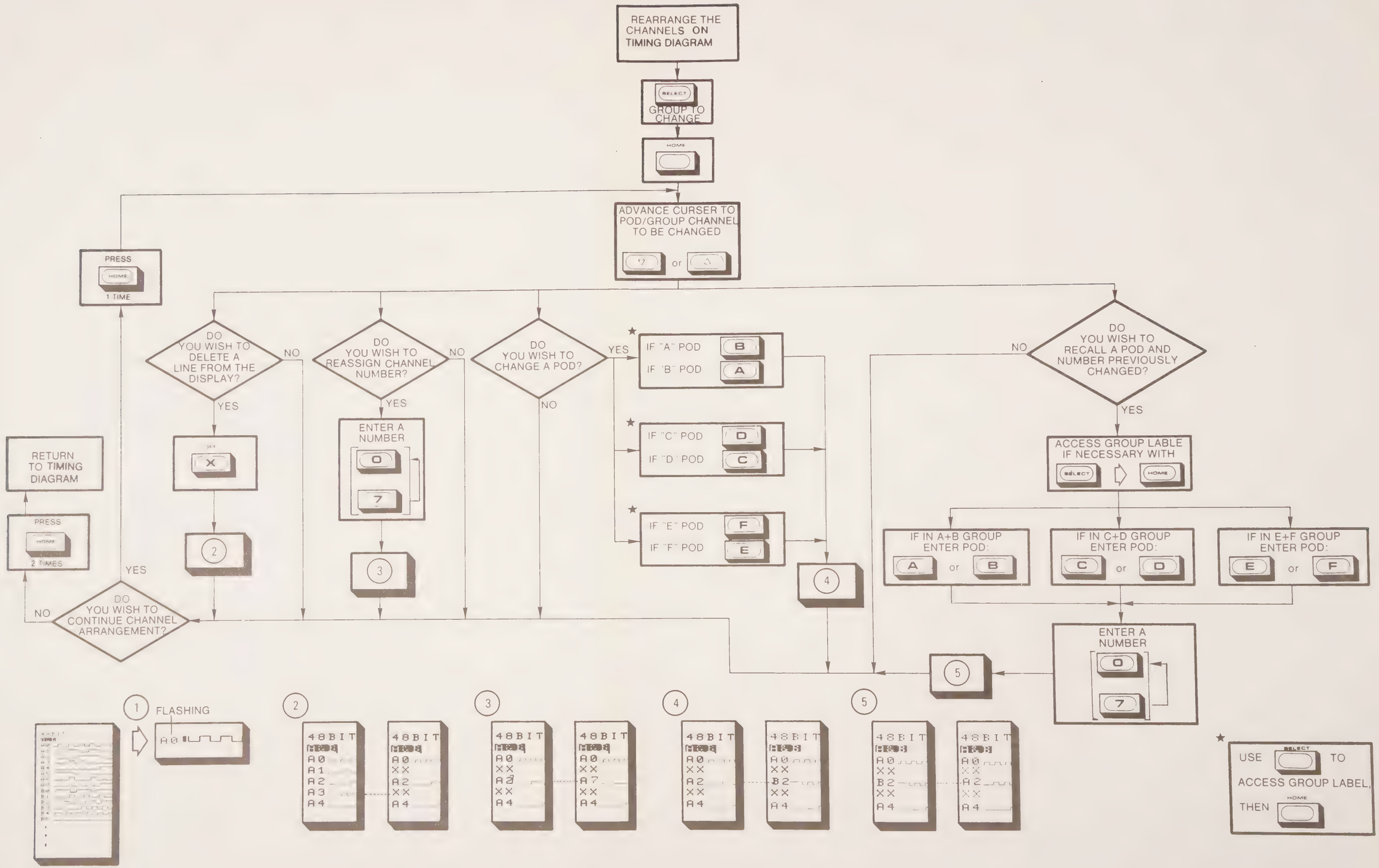



FIGURE 5-31. TIMING DIAGRAM CHANNEL ARRANGEMENT

### 5.5.3 Timing Diagram Search Functions

This section provides details on procedures used to operate the search functions. Figure 5-33 shows the selection order. Figure 5-34 is a flowchart showing these procedures on several pages. Additionally, means of analysing the search results are given after the sections explaining those functions. The search functions associated with the TIMING DIAGRAM provide powerful and flexible means of analysing recorded data. The following search functions are available:

- S = R
- S ≠ R
- Word
- Sequence

Note that the order presented is not the same as selections order. This is done for clarity of explanation. In Figure 5-33 the selection order is maintained. It is important for the user to know that the search mode selected is only done for the data Pod displayed--not for all active Pod groups. Also note that the memory format used effects the search functions. In the 1K Format the memory is tested from location 0 to 999 of the programmed search condition. In the 2K Format the search is done for the whole Pod group, but only in the range of the 1K Pod group, E + F, depending on the POD SKEW programmed. See Section 5.3.1.5 for details. If in the 2K Format, the Pod groups E + F are turned OFF, the search is done automatically from location 0 to 1999.

**5.5.3.1 S = R.** When this function is selected, the analyzer executes a search in the range of the allowable area (either 1K or 2K formats). It searches for conditions when the Source Memory equals the Reference Memory. During this time it displays the number of search cycles (SEARCH EVENT) and the total number of times the condition is true (TOTAL). See Figure 5-34A for operating details.

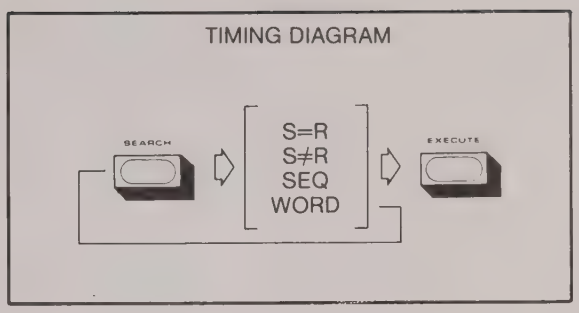



FIGURE 5-33. TIMING DIAGRAM SEARCH SELECTION

**5.5.3.2 S ≠ R.** This function operates in the same way as the S = R function, except that the analyzer looks for unequal conditions between the Source and Reference Memories. See Figure 5-34A for operating details.

**5.5.3.4 Word.** The Word search function allows the user to input a particular word desired for search directly into the TIMING DIAGRAM display. The word is entered in Binary form for all channels desired. When this mode is executed, the analyzer will search for the word and display the first occurance of it in memory. See Figure 5-34D for details on operating procedures to program the Word search.

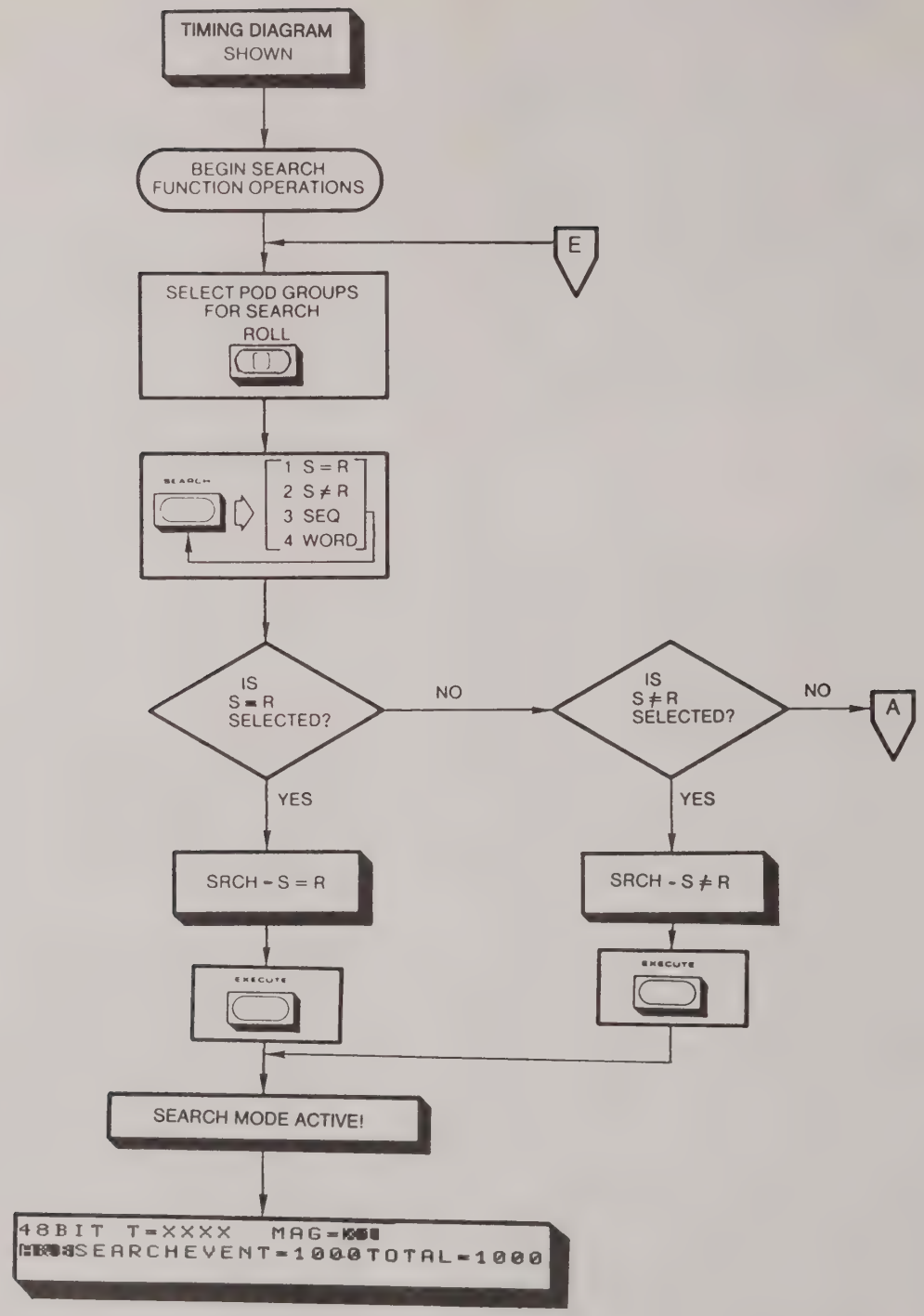



FIGURE 5-34A. TIMING DIAGRAM SEARCH

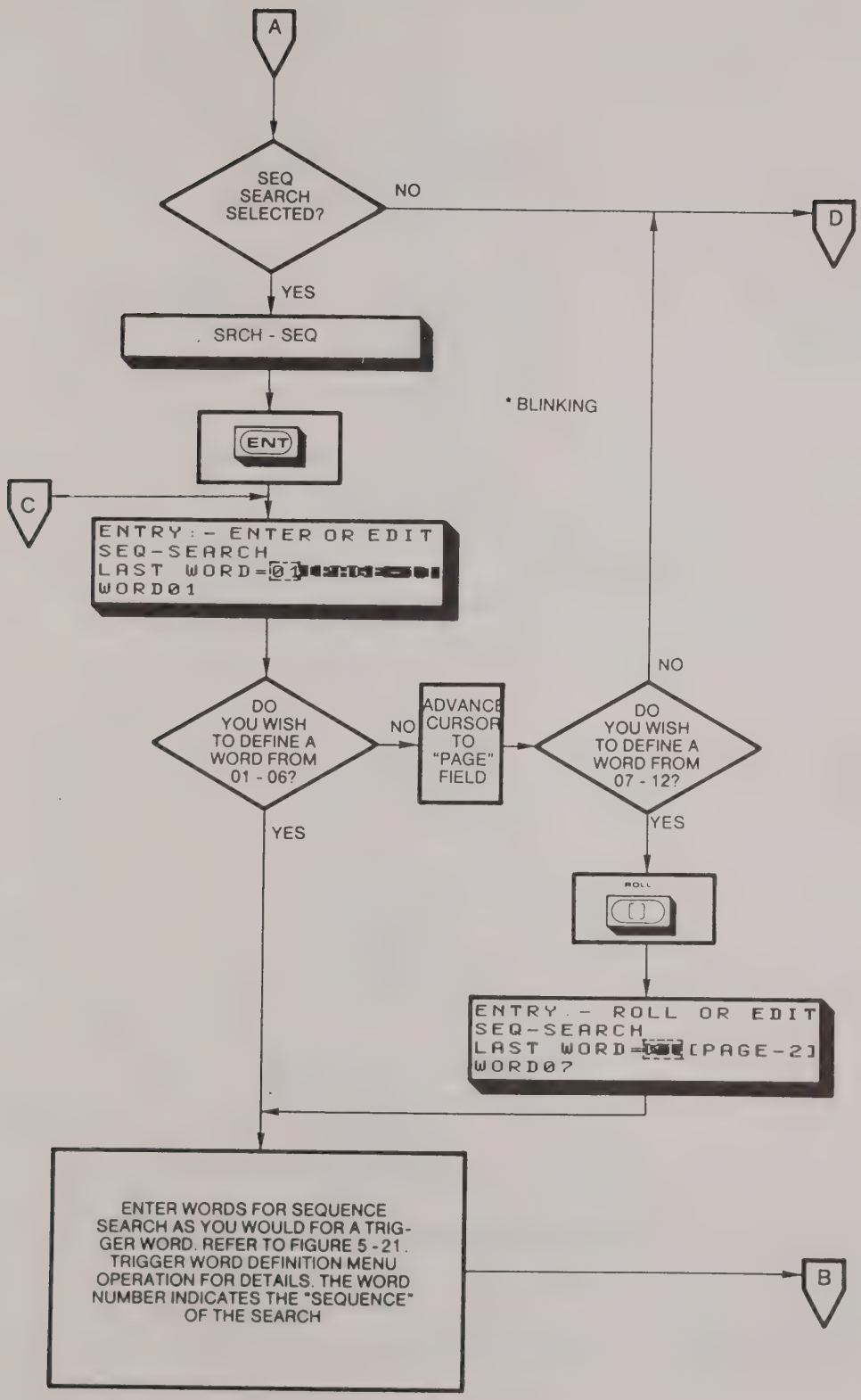



FIGURE 5-34B. TIMING DIAGRAM SEARCH

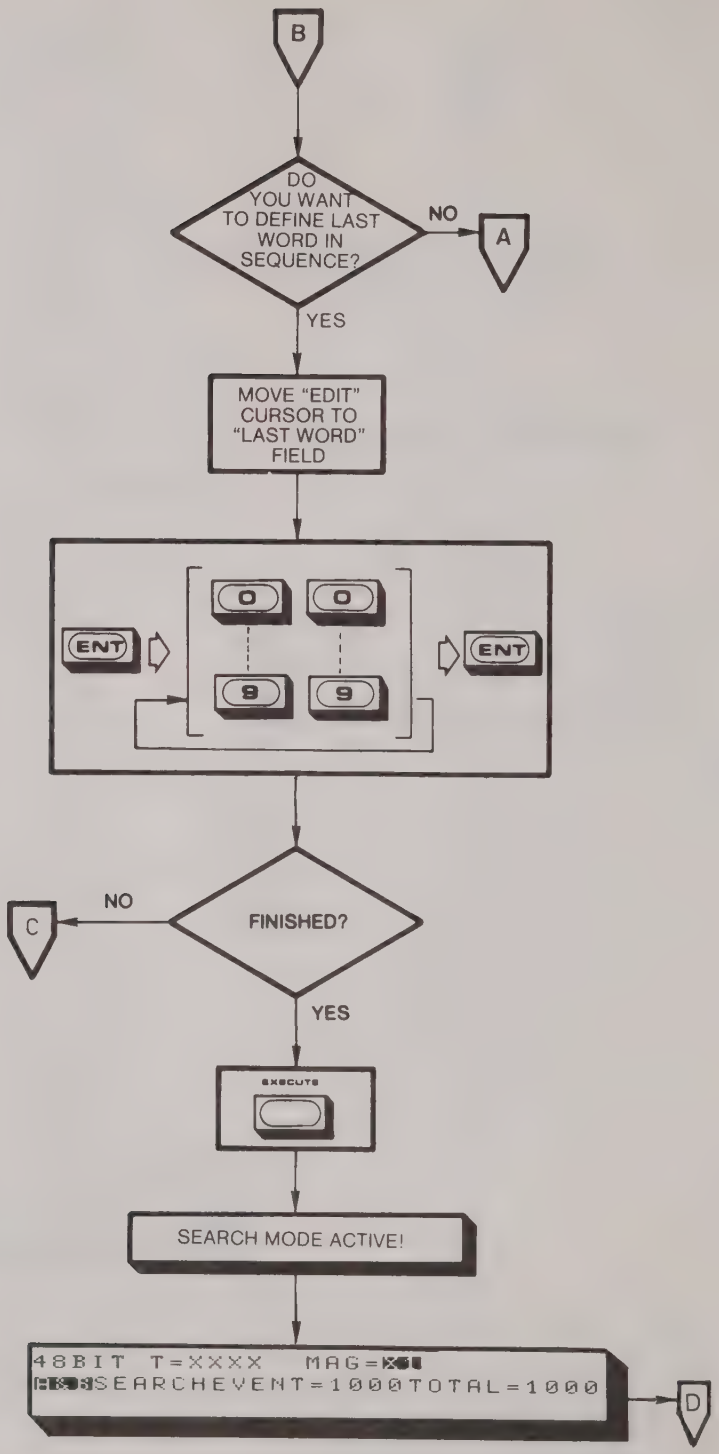



FIGURE 5-34C. TIMING DIAGRAM SEARCH

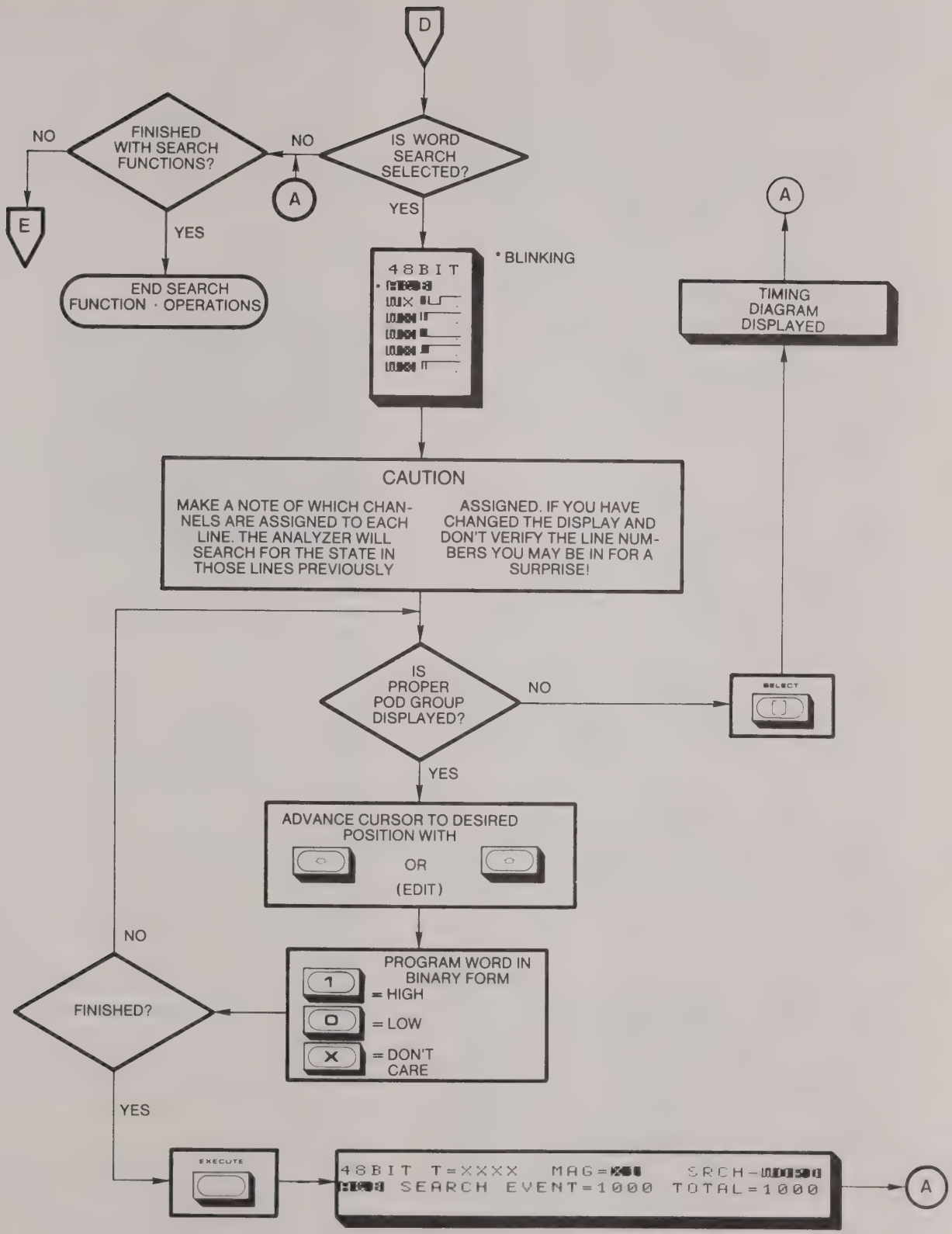



FIGURE 5-34D. TIMING DIAGRAM SEARCH

5.5.3.5 Interpreting S = R, S ≠ R, and WORD SEARCH Results. See Figure 5-35 for reference in the following discussion. At every true event of the programmed mode, an internal counter is incremented beginning at 0, and is shown in the "TOTAL" field heading. After the search is executed, the cursor moves automatically to the beginning position of the next search event in the programmed mode. The automatic direction of cursor movement is towards the higher number in memory location. As with the Memory Functions, differences of data are also shown in inverse video in the Binary Information field. An indication of the present cursor position is shown in the "SEARCH EVENT" field heading as well as in the CUR = XXX field.

By pressing the "EXECUTE" pushbutton, the user may advance the cursor through the memory to find each occurrence of a "true" condition. At the first pressing of the "EXECUTE" pushbutton, the cursor moves to the beginning of the event and displays the "TOTAL" number of conditions true. At the next pressing of the "EXECUTE" pushbutton, the cursor moves to the end of the event. This action can be repeated indefinitely.

Note:

Use only the "CURSOR" group pushbuttons to move the cursor locations through the display. If you change the TIMING DIAGRAM, or exit from it, the Search function selected will be disabled.

If there are more than one events that follow immediately, one after the other, the cursor moves to the beginning of the first block at an EXECUTE command (SEARCH EVENT). The cursor moves to the end of the block of search events. At the next "EXECUTE" command, this operation is repeated until the highest number of events in the memory has been reached. The cursor then automatically recycles back to the beginning of the memory (or search area).

Between every "EXECUTE," after search, the user may move the cursor at random to any position in the TIMING DIAGRAM without disabling the search mode selected. This movement is accomplished with the cursor movement pushbuttons in the keyboard "CURSOR" group only. As long as the "SEARCH EVENT" and "TOTAL" messages are displayed, the cursor can be moved in the search mode. When the TIMING DIAGRAM is further modified, the search mode is disabled.

5.5.3.6 **Sequence.** The Sequence search function is an extended word search. When this function is selected, a maximum of 12 words (each up to 48 bits wide) may be searched for in a programmed sequence. The sequence search is presented on two "pages." Page one provides programming for words 1 through 6, and page two provides programming for words 7 through 12. The number of the word entered is its number in the sequence. The analyzer will look for each occurrence of that particular sequence. The "Last Word" is used to tell the analyzer where to stop in the sequence. Thus, a sequence of 12 words may be entered, but the user may program varying length of the sequence by using the "Last Word" option. Figure 5-34B and 5-34C describes the procedures used to program the Sequence Search.

5.5.3.7 **Interpreting Sequence Search Results.** When the Sequence function is executed and the results are displayed, the interpretation is somewhat different from the other search functions. The "TOTAL" then means that this is the number of completely found programmed sequences--not the number of single words contained in a sequence event. Also, by pressing the "EXECUTE" pushbutton, the cursor moves automatically to the next beginning of a true sequence--not to the end of the current event.

As with the other Search functions, the cursor may be moved at random within the TIMING DIAGRAM as long as this search function is active. It will be disabled once the TIMING DIAGRAM is further modified.

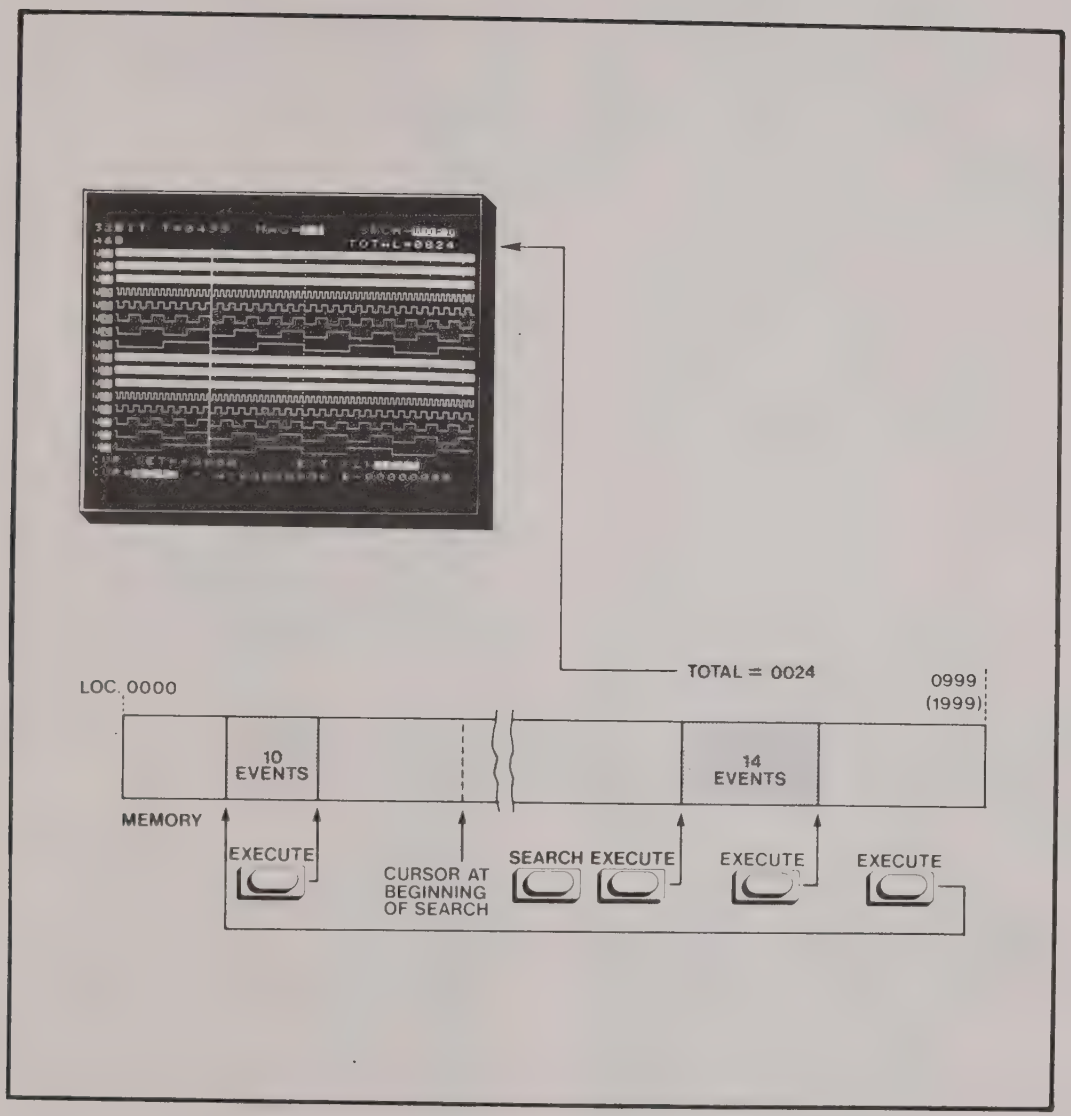



FIGURE 5-35. EXECUTING SEARCH IN TIMING DIAGRAM

### 5.5.4 List Display Analysis

The LIST DISPLAY primarily shows the data recorded at each memory location of all line channels in numerical form. It also provides control over the analyzer memory and search functions. These are covered in separate sections under their respective titles. Refer to Figure 5-36 in the following explanation of the LIST DISPLAY operation. Circle numbers in the figure are keyed to the text in this section. The LIST DISPLAY provides these controls:

- Cursor movement and control
- Making sample measurements
- Changing Pod groups parameters
- Arranging channels in display
- Controlling memory
- Search functions

**5.5.4.1 Cursor Movement And Control.** Cursor movement is shown in Figure 5-36. Circle number ① shows that the cursor can be moved up or down on the monitor with the Keyboard CURSOR group pushbuttons. Circle number ② shows how to posiiton the "Set" point. Number ③ illustrates how to directly enter the location desired for the cursor.

**.5.4.2 Making Sample Measurements.** Sample memory measurements are expressed as the difference between the cursor's present position and a selectable Cursor "Set" point as shown in the field heading "C = S +/- XXXX" (Circle number ④) in the LIST DISPLAY. Note that as in the TIMING DIAGRAM the sample measurement works in both directions from the cursor set point.

The normal procedure for making logic measurements is to select an area of interest on the display. Then proceed as follows:

1) Position the cursor, either by pressing the CURSOR pushbuttons (CURSOR group) or by directly entering the desired location.

2) Press the "Set" pushbutton to fix the "Set Point".

3) Position the cursor again to either before or after the set point, by using the CURSOR pushbuttons or by direct location.

The measurement is the resultant difference between the new cursor position and the set point, as expressed in the "C=S +/- XXXX" field heading.

**5.5.4.3 Changing Pod Group Parameters.** As with the TIMING DIAGRAM, it is sometimes helpful to view the LIST DISPLAY in a way that it is not normally presented. For instance, the user may wish to delete Pods, change the number base, etc. It is possible to make such changes to Pod groups that are already displayed on the monitor (not previously changed). Number keys to Figure 5-36 that show procedures and the changes possible are as follows:

- Turn a Pod OFF (delete from display) ⑥
- Change the Pod name ⑦
- Change the Pod polarity ⑧
- Change the number base ⑨

To make the changes listed above, the cursor must be in the "HOME" position. This is indicated by the "Greater Than" sign in flashing inverse video. See circle number ⑤. With these functions, it is possible to mix number bases of Pod groups on the display. For instance, Pod group A may be presented in Binary, Pod group B in Hex. and Pod group C in Octal.

**5.5.4.4 Arranging Channels In The Display.** The procedure to add a Pod group back to the display once it has been deleted is shown in circle number ⑩.

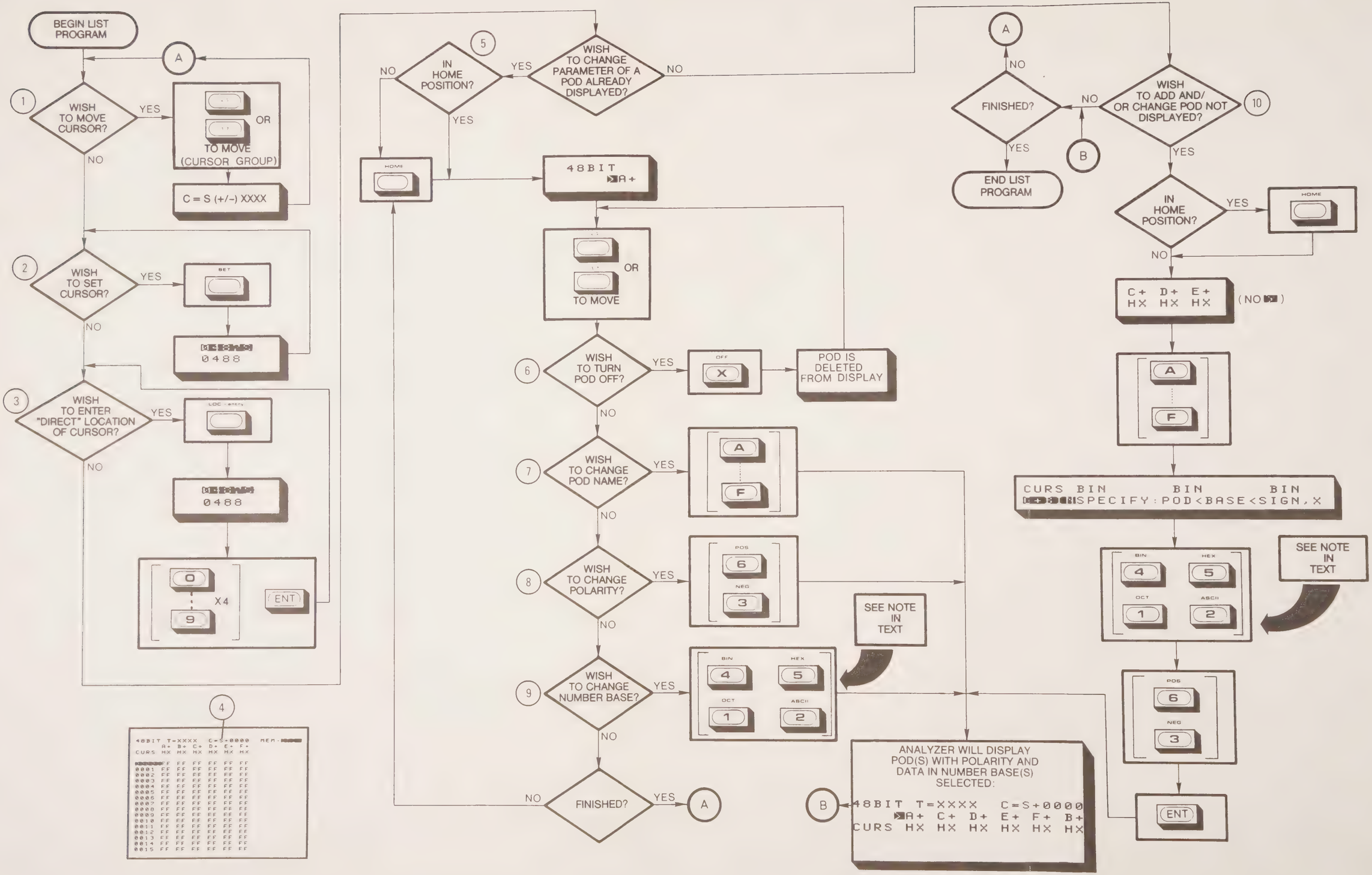



FIGURE 5-36. LIST DISPLAY OPERATION

NOTE

Pod groups display is limited by the size of the CRT. Therefore the column (Pod) to be reprogrammed assumes highest priority. The analyzer performs a shift operation of the displayed data, depending on how much space is available in either direction. The analyzer will warn the user prior to the "EXECUTE" command which Pod(s) will be deleted. This is done by flashing the label(s) in inverse video.

### 5.5.5 List Display Memory Functions

In the LIST DISPLAY, it is possible to call up the contents of the Source Memory (SRC), the Reference Memory (REF), an OR function of both Reference and Source memories (R + S), and an EXCLUSIVE OR of the Source and Reference memories (S + R). Figure 5-37 shows how these functions are selected.

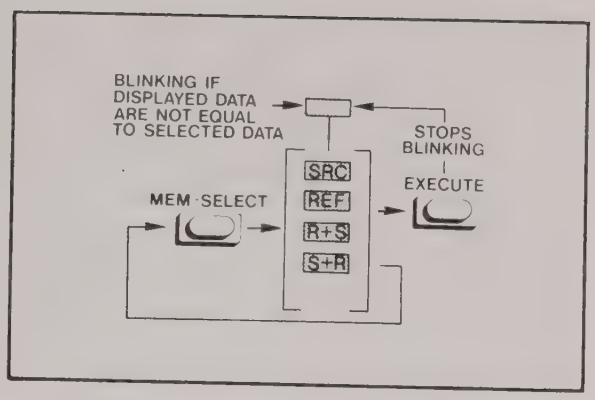



FIGURE 5-37. LIST DISPLAY MEMORY SELECTION

**5.5.5.1 SRC.** When the LIST DISPLAY is initially selected, it shows the Source Memory contents. This is presented in numerical form, depending upon the number base selected. The initial display shows Pod group data in Hexadecimal form.

**5.5.5.2 REF.** When the "MEM-select" pushbutton is pressed the first time, the "REF" function is shown in the "MEM" field of the display. Pressing the "EXECUTE" pushbutton causes the contents of the Reference memory to be displayed.

**5.5.5.3 R+S.** When the "MEM-select" pushbutton is pressed a second time, the "R+S" function is shown in the "MEM" field of the display. Pressing the "EXECUTE" pushbutton causes the Reference Memory to be displayed, but with an OR indication of every location corresponding to the same Source Memory location. If there is a difference of data at the corresponding locations, these positions are highlighted in inverse video. Movement of the cursor in either direction shows the differences between the two memories in inverse video.

**5.5.5.4 S+R.** When the "MEM- select" pushbutton is pressed a third time, the "S+R" function is shown in the "MEM" field of the display. Its function is exactly the same as the "R+S" except that the OR is based upon the Source Memory contents.

**5.5.5.5 S->R.** When the "MEM-select" pushbutton is pressed a fourth time, the "S->R" function is shown in the "MEM" field of the display. Pressing the "EXECUTE" pushbutton causes the analyzer to transfer data from the present Source Memory to the Reference Memory. All previous Reference Memory information is lost, and it is replaced by the old Source Memory. A new recording (Source) can be now done, and a comparison between the old Source (now Reference) and the new Source data can be made.

### 5.5.6 List Display Search Functions

This section provides details on procedures used to operate the search functions. Figure 5-38 shows the selection order. Figure 5-39 is a flowchart showing these procedures on several pages. Additionally, means of analysing the Search results are given after the section explaining those functions. The search functions associated with the LIST DISPLAY provide powerful and flexible means of analysing recorded data. The following search modes are available:

- S = R
- S ≠ R
- Word
- Sequence

Note that the order presented is not the same as selection order. This is done for clarity of explanation. In Figure 5-38, the selection order is maintained. It is important for the user to know that the search mode selected is only done for the data Pod displayed--not for all active Pod groups. Also note that the memory format used effects the search functions. In the 1K Format, the memory is tested from location 0 to 999 of the programmed search condition. In the 2K Format, the search is done for the whole Pod group, but only in the range of the 1K Pod group, E+F, depending on the POD SKEW programmed. See section 5.3.1.5 for details. If, in the 2K Format, the Pod groups E+F are turned off, the search is done automatically from location 0 to 1999.

**5.5.6.1 S = R.** When this function is selected, the analyzer executes a search in the range of the allowable area (either 1K or 2K formats). It searches for conditions when the Source memory equals the Reference memory. During this time, it displays the number of search cycles (SEARCH EVENT) and the total number of times the condition is true (TOTAL). See Figure 5-39A for operating details.

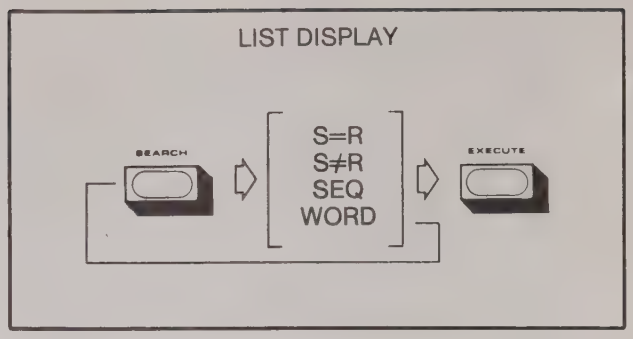



FIGURE 5-38. LIST DISPLAY SEARCH SELECTION

**5.5.6.2 S ≠ R.** This function operates in the same way as the S = R function, except that the analyzer looks for unequal conditions between the Source and Reference memories. See Figure 5-39A for operating details.

**5.5.6.3 Word.** The word search function allows the user to input a particular word desired for search directly into the LIST DISPLAY. The word is initially entered in Hexadecimal form for all channels desired. When this mode is executed, the analyzer will search for the word and display the first occurance of it in memory. See Figure 5-39B for details on operating procedures to program the Word search.

**5.5.6.4** Interpreting S=R, S≠R, and WORD Search Results. See Figure 5-40 for reference in the following section. At every true event of the programmed mode, an internal counter is incremented beginning at 0, and is shown in the "TOTAL" field heading. After the search is executed, the cursor moves automatically to the beginning position of the next search event in the programmed mode. The automatic direction of cursor movement is towards the higher number in memory location. As with the Memory Control functions for the LIST DISPLAY, differences of data are also shown in inverse video. An indication of the present cursor position is shown in the "SEARCH EVENT" field heading as well as the "CUR=XXXX" field.

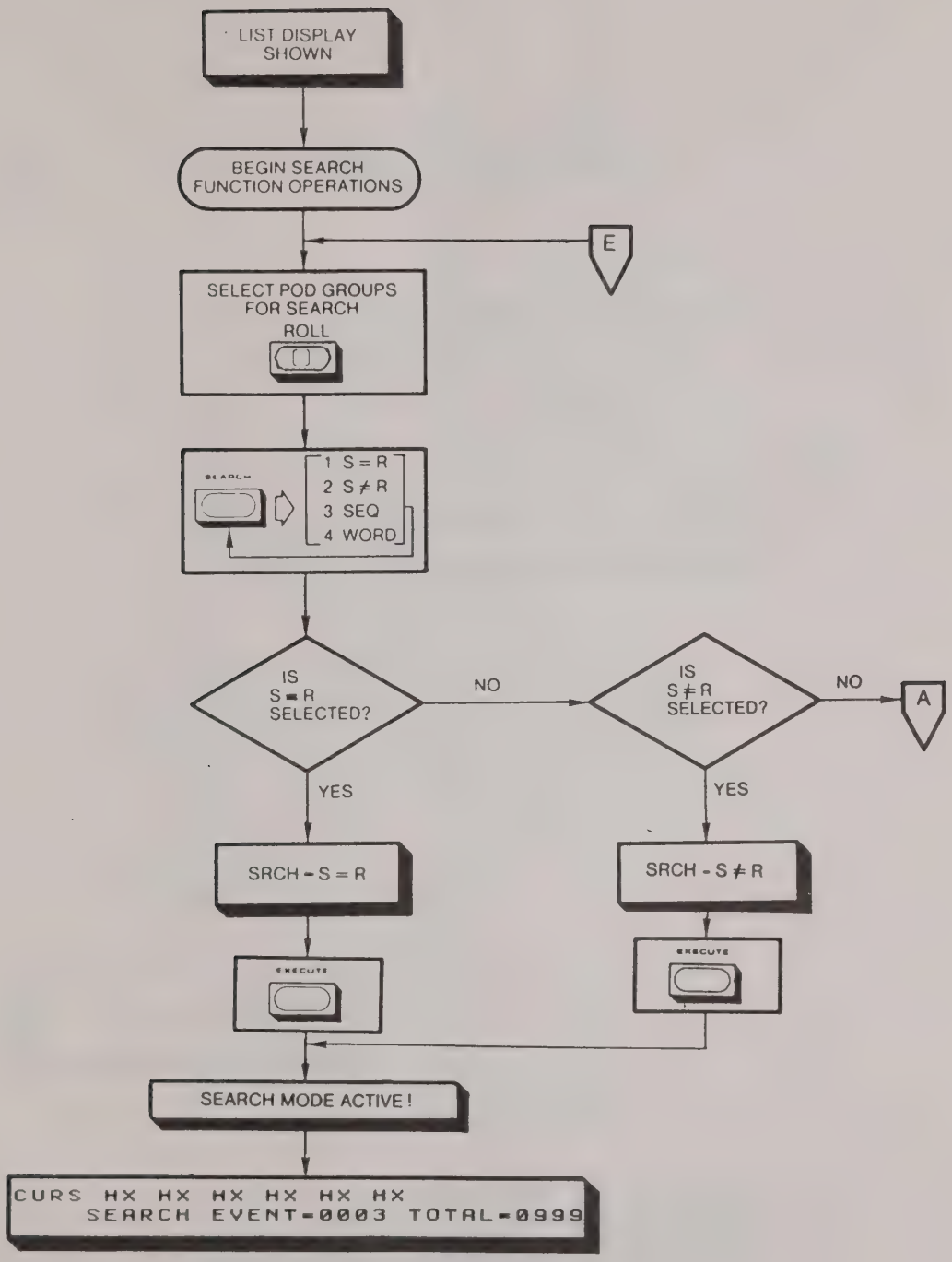



FIGURE 5-39A. LIST DISPLAY SEARCH

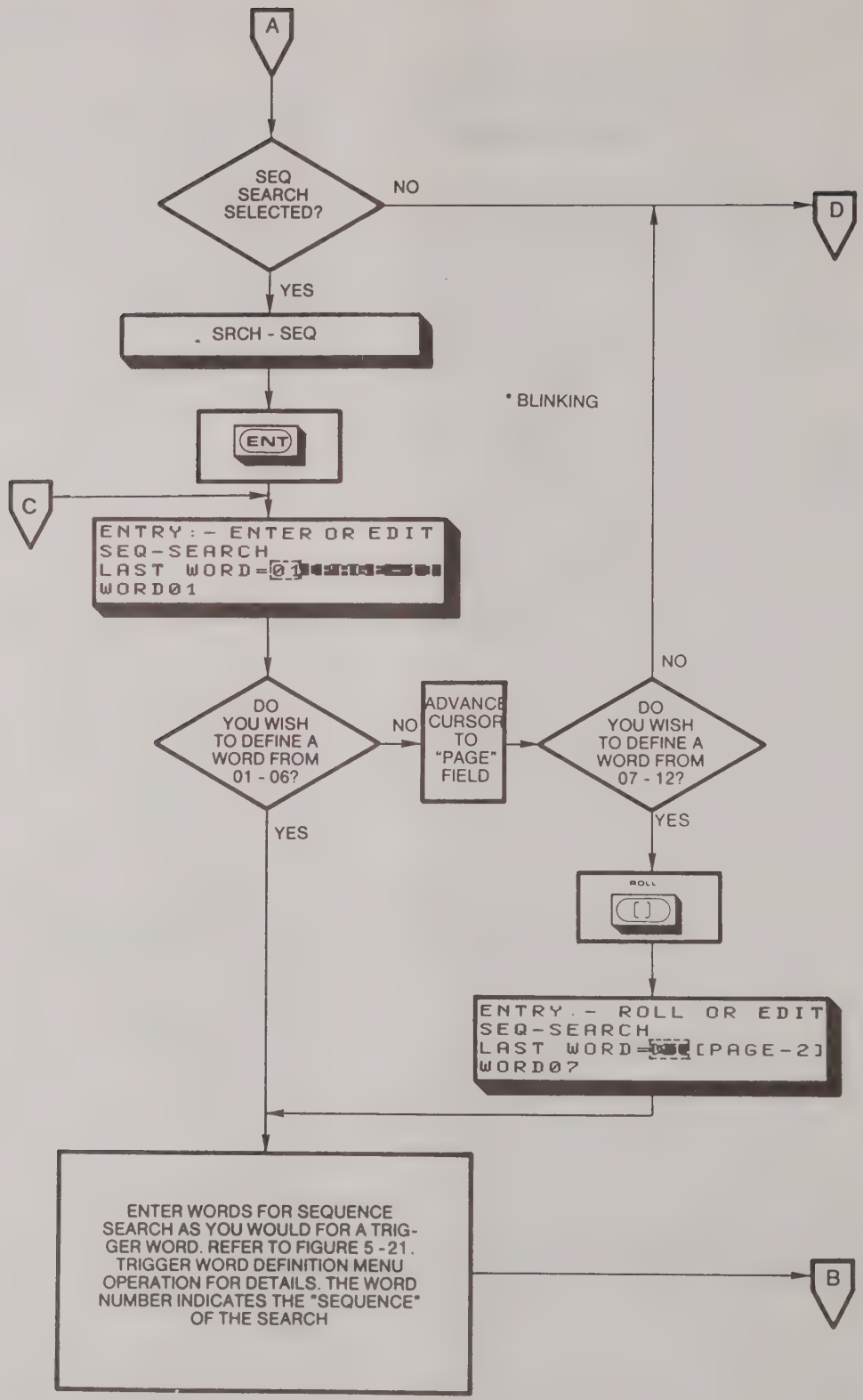



FIGURE 5-39B. LIST DISPLAY SEARCH

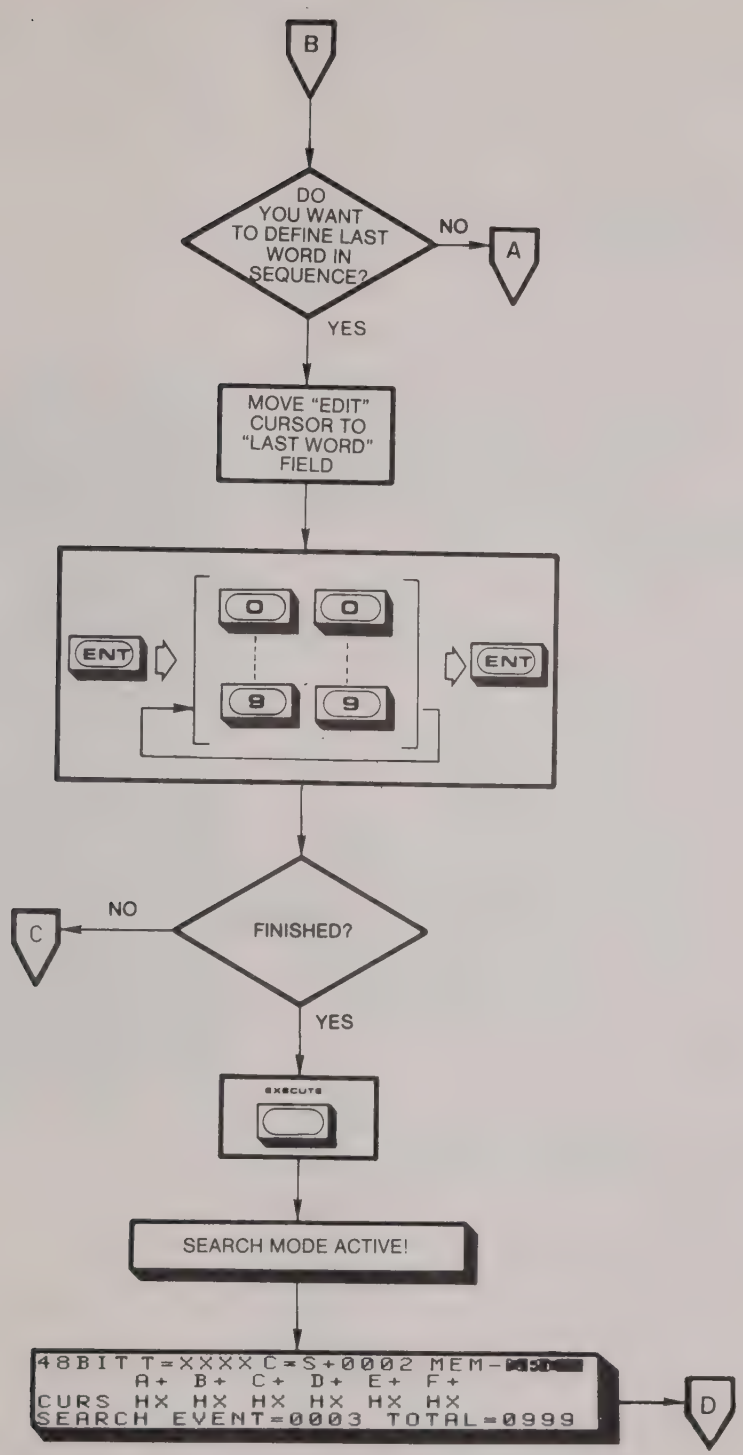



FIGURE 5-39C. LIST DISPLAY SEARCH

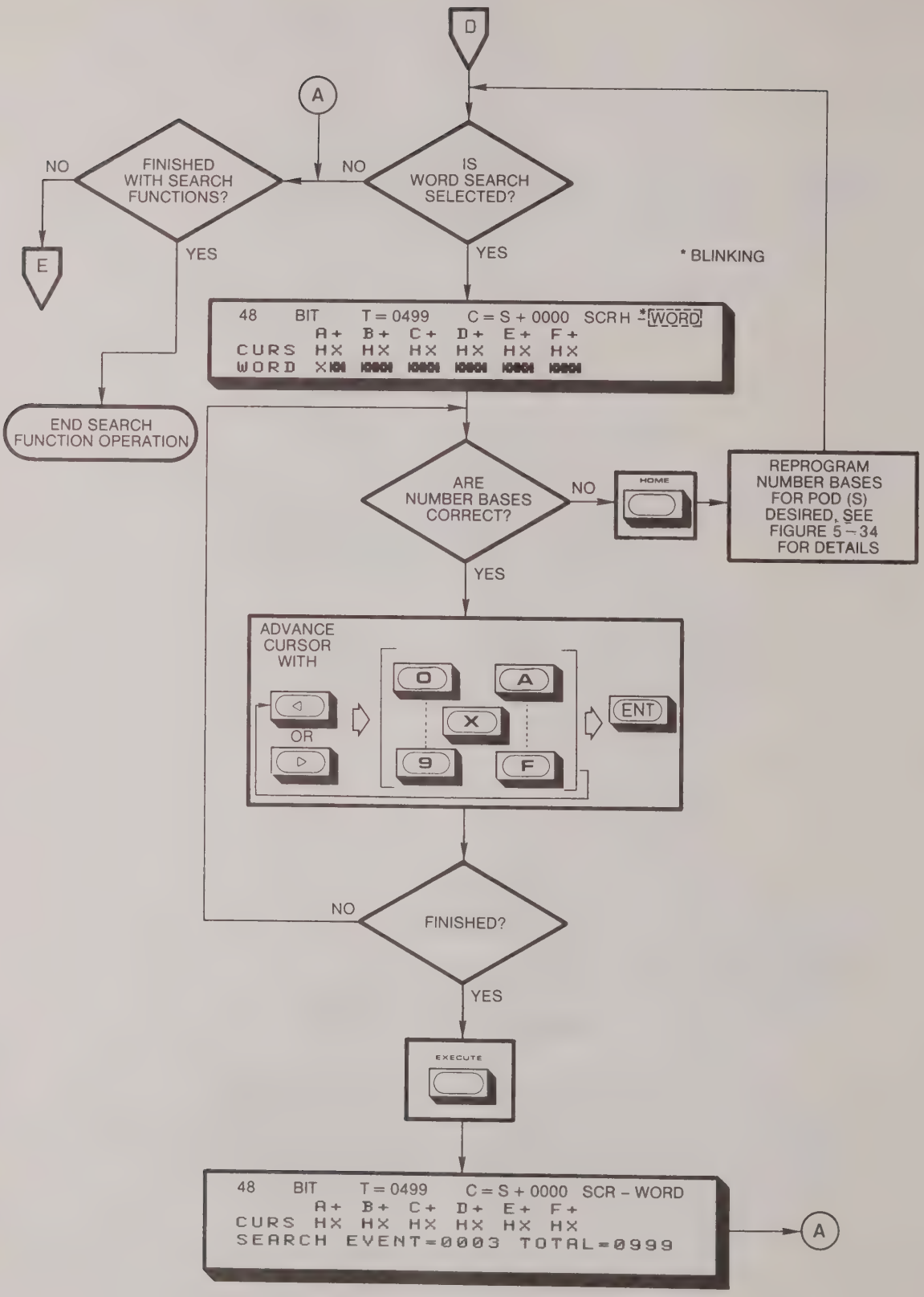



FIGURE 5-39D. LIST DISPLAY SEARCH

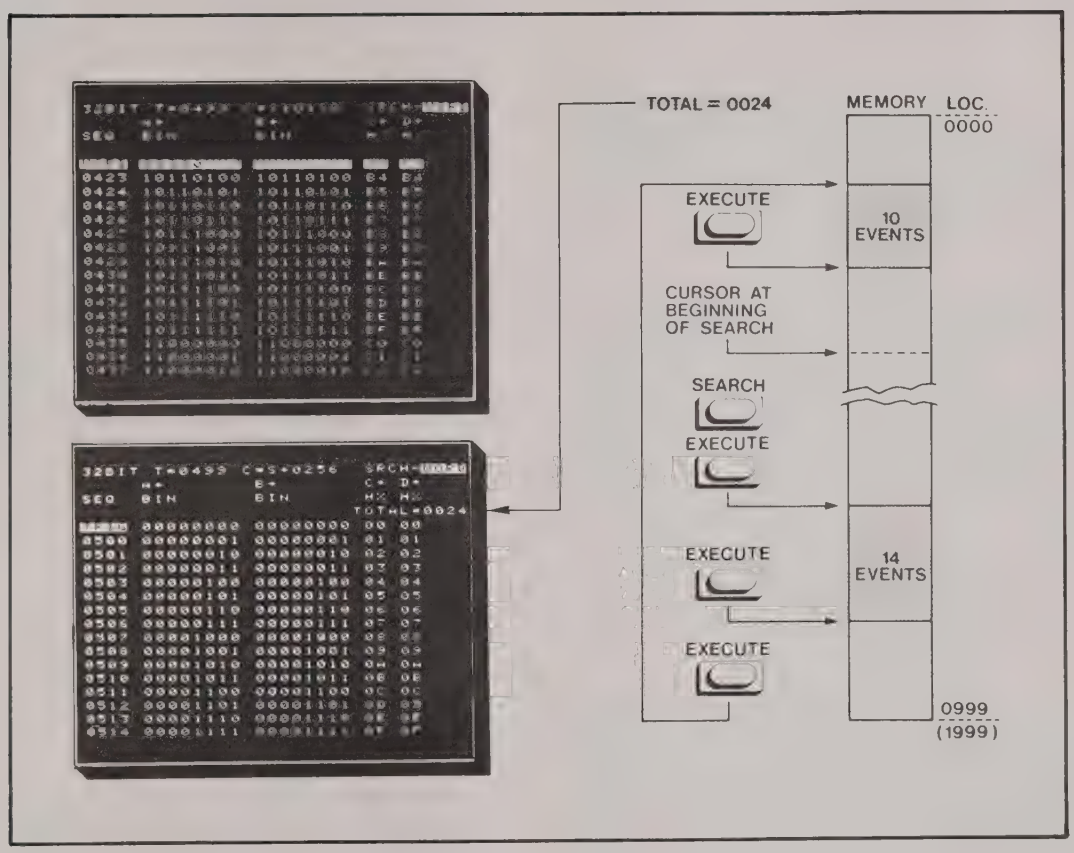



FIGURE 5-40. EXECUTING SEARCH IN LIST DISPLAY

By pressing the "EXECUTE" pushbutton, the user may advance the cursor through the memory to find each occurrence of a "true condition". At the first pressing of the "EXECUTE" pushbutton, the cursor moves to the beginnng of the event and displays the "TOTAL" number of conditions true. At the next pressing of the "EXECUTE" pushbutton, the cursor moves to the end of the event. This action can be repeated indefinitely.

Note

Use only the "CURSOR" group pushbuttons to move the Cursor locations through the display. If you change the LIST DISPLAY, or exit from it, the Search function selected will be disabled.

If there are more than one events that follow immediately, one after the other, the cursor moves to the beginning of the first block at an "EXECUTE" command (SEARCH EVENT). The cursor moves to the end of the block of search events. At the next "EXECUTE" command, this operation is repeated until the highest number of events in the memory has been reached. The cursor then automatically recycles back to the beginning of the memory (or search area).

Between every "EXECUTE," after search, the user may move the cursor at random to any position in the LIST DISPLAY without disabling the search mode selected. This movement is accomplished with the cursor movement pushbuttons in the keyboard CURSOR group only. As long as the "SEARCH EVENT" and "TOTAL" messages are displayed, the cursor can be moved in the search mode. When the LIST DISPLAY is further modified, the search mode is disabled.

**5.5.6.5 Sequence.** The Sequence Search function is an extended word search. When this mode is selected, a maximum of 12 words--each up to 48 bits wide--may be searched for in a programmed sequence. The Sequence Search is presented on two "pages". Page one provides programming for words 1 through 6, and page two provides programming for words 7 through 12. The number of the word entered is its number in the sequence. The Analyzer will look for each occurrence of that particular sequence. The "Last Word" is used to tell the analyzer where to stop in the sequence. Thus, a sequence of 12 words may be entered, but the user may program varying length of the sequence by using the "Last Word" option. Figure 5-39B and 5-39C describes the procedures used to program the Sequence Search.

**5.5.6.6 Interpreting SEQUENCE Search Results.** When the Sequence function is executed and the results are displayed, the interpretation is somewhat different from the other search modes. The "TOTAL" then means that this is the number of completely found programmed sequences--not the number of single words contained in a sequence event. Also, by pressing the "EXECUTE" pushbutton, the cursor moves automatically to the next beginning of a true sequence--not to the end of the current event.

As with the other Search functions, the cursor may be moved at random within the LIST DISPLAY as long as this Search mode is active. It will be disabled once the LIST DISPLAY is further modified.

In the LIST DISPLAY, the complete sequence (depending on the number of the last word) is explained by the "GREATER THAN" sign and "X" at the beginning of the data line (immediately to the right of the memory location number). A blinking sign marks the beginning of the sequence. The "GREATER THAN" sign indicates a programmed value, where the "X" indicates a "DON'T CARE" Word within the search sequence.

### 5.5.7 Data Analysis Options

Option selection procedures for the Data Analysis Mode are the same as those for the Pre-Record Programming Mode. Refer to section 5.3.6 for details.

## 5.6 FILE MANIPULATION MODE

The LAM 4850A provides memory for storage of menus, set-ups, and word search definitions. These are accessed through the SCRATCH TABLE. Figure 5-41 shows the SCRATCH TABLE. The user may store these files in memory for up to three months without main power. This allows several users to share the unit and makes it easier to configure it for different analysis needs.

The SCRATCH TABLE memory is organized into a 6 by 6 matrix. A total of 6 set-ups (files) may be stored for 6 different types of menus and displays. Storing and recalling of files can be done singly or for all states.

The SCRATCH TABLE provides the following functions:

- Storing Files (5.6.2)
- Storing All Files To The Same Number (5.6.3)
- Recalling Files (5.6.4)
- Recalling All Files With The Same Number (5.6.5)

Operating instructions for each function are presented in this section. Note that it is possible to use each function only once (Single Mode) or to sequentially repeat that function (Multiple Mode).

### 5.6.1 Scratch Table Operating Notes

The following items should be noted before beginning operations in the SCRATCH TABLE:

1. Use the Keyboard "EDIT" group pushbuttons to control cursor movement in the table.

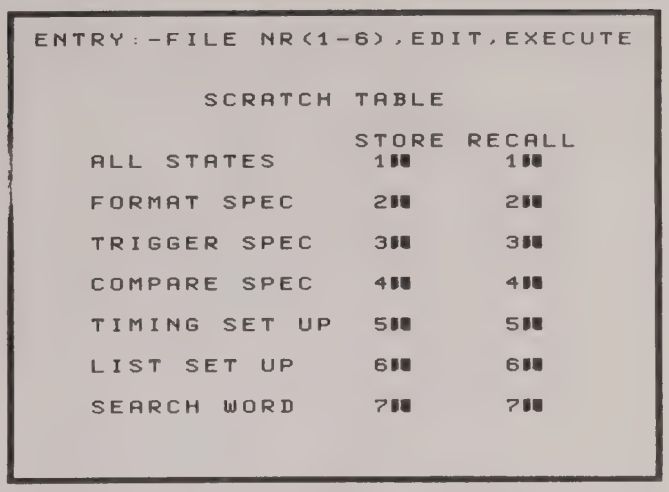



FIGURE 5-41. SCRATCH TABLE

2. To store or recall a specific menu or display, you must first enter the menu or display set-up and then press the "SCRATCH"pushbutton. The analyzer will return to that menu or display selected after each "EXECUTE" command until another file is selected.

3. After store or recall operations, the analyzer will return to the last menu or display set-up selected. The exception to this is the "SEARCH WORD" field. The analyzer will return either to the last TIMING DIAGRAM or LIST DISPLAY programmed for word search. After each return, the file number is incremented.

4. If the user has programmed a menu while the "X" is showing in the "FILE" field heading, and reaches a point where the set-up parameters match those of another one already in memory, the "X" will be changed to the number of the file in memory. The converse is also true: If the user changes a file with a number displayed, the "X" will appear.

5. The "FILE" field heading is not displayed for the LIST DISPLAY, TIMING DIAGRAM, or SEARCH WORD files.

6. If a set-up display is stored in more than one file number, at recall, the lowest file number is displayed as long as the file contents is the same. The user may then decide how many files may be "written" over.

7. To store or recall in the "ALL STATES" or "SEARCH WORD" files, the cursor must be positioned with the "EDIT" group pushbuttons to the field desired.

8. If the memory of the SCRATCH TABLE is empty, a "FIRST INVALID FILE 11" message will be displayed at power on. All menus and displays must be reloaded. This message also indicates the first free file number after files have been stored at each subsequent power on.

### 5.6.2 Store File Operation

It is possible to store a particular menu or display set-up in both single and multiple modes. Figure 5-42A and 5-42B show the operating procedures.

### 5.6.3 All States Store

As with individual file storage, this function may be operated in both single and multiple modes. However, the difference is that when a number is selected for storage, all file numbers will be stored in one block and assigned as the file number. It is therefore advisable to quickly recall all files in memory to make sure that the SCRATCH TABLE is properly configured before you perform this operation. All menus and display set-ups that are active (those which can be immediately accessed without further recall) will be stored to the number assigned in the ALL STATES STORE function under their individual file numbers. It may be useful to keep a log of all file management changes. Figure 5-43A and 5-43B show the operation for the ALL STATES STORE function.

### 5.6.4 Recall File Operation

It is possible to recall a particular menu or display set-up in both single and multiple modes. Figure 5-43A and 5-43B shows the operating procedures. If a file number is recalled that does not exist, the analyzer will display a message to indicate this.

### 5.6.5 All States Recall

The ALL STATES RECALL function operation is exactly like that of the ALL STATES STORE with the exception that entire file numbers can be recalled in blocks. Figures 5-44A and 5-44B show the operation for this function.

78343N

NOTES

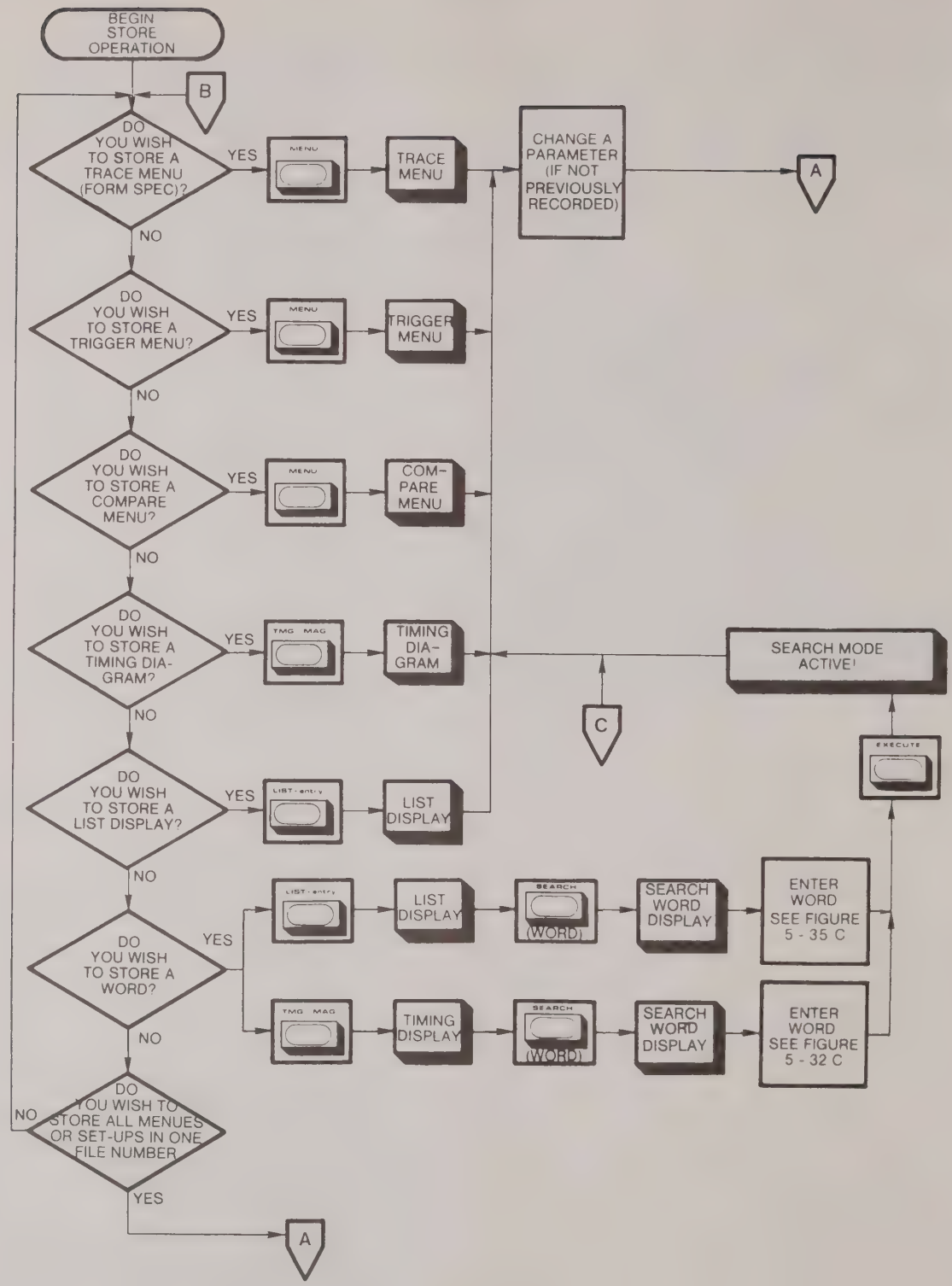



FIGURE 5-42A. STORE FILE OPERATION

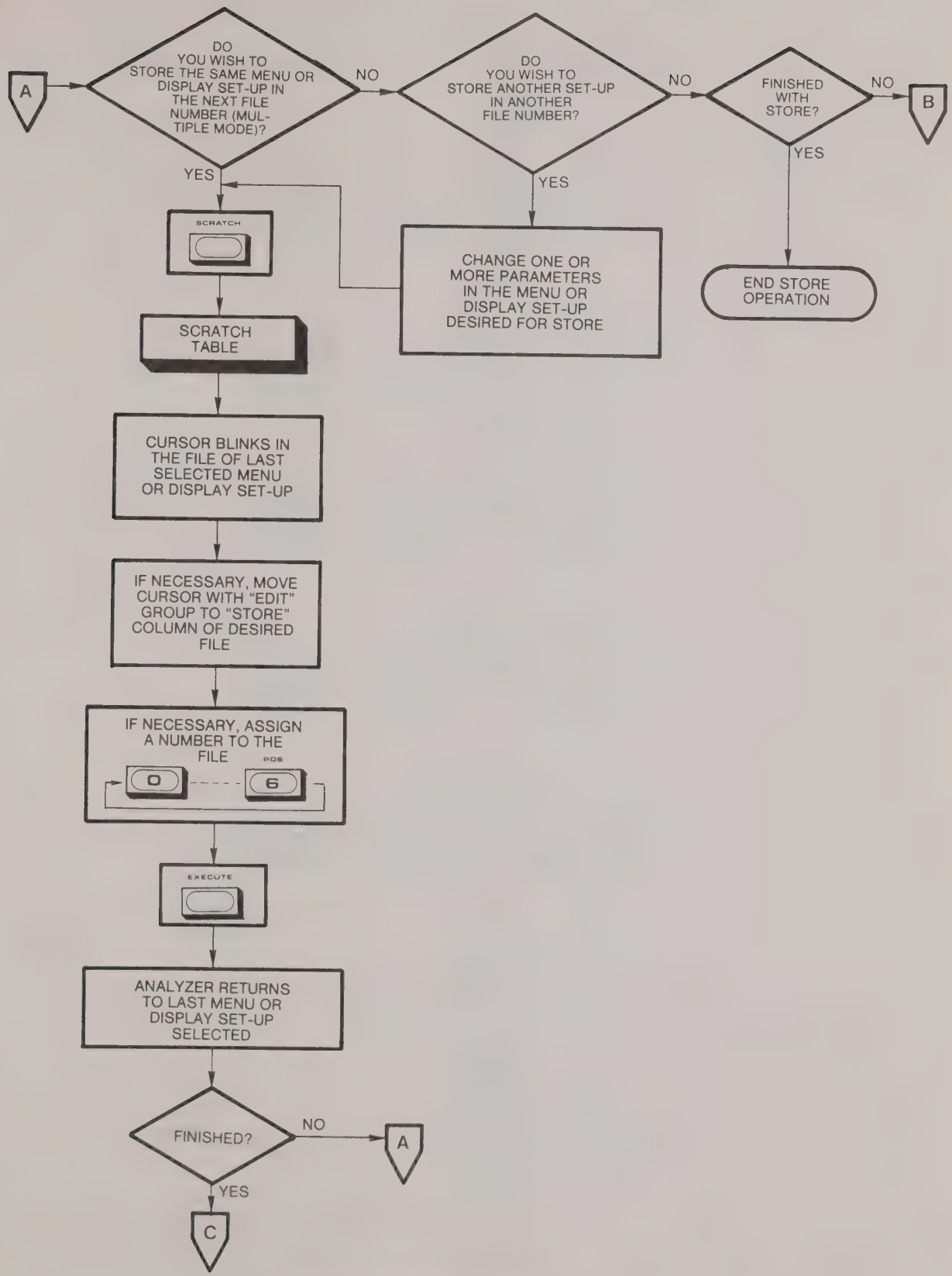

A
DO YOU WISH TO STORE THE SAME MENU OR DISPLAY SET-UP IN THE NEXT FILE NUMBER (MULTIPLE MODE)?
NO
DO YOU WISH TO STORE ANOTHER SET-UP IN ANOTHER FILE NUMBER?
NO
FINISHED WITH STORE?
NO
B
YES
YES
YES
SCRATCH
SCRATCH TABLE
CHANGE ONE OR MORE PARAMETERS IN THE MENU OR DISPLAY SET-UP DESIRED FOR STORE
END STORE OPERATION
CURSOR BLINKS IN THE FILE OF LAST SELECTED MENU OR DISPLAY SET-UP
IF NECESSARY, MOVE CURSOR WITH "EDIT" GROUP TO "STORE" COLUMN OF DESIRED FILE
IF NECESSARY, ASSIGN A NUMBER TO THE FILE
POS
0
6
EXECUTE
ANALYZER RETURNS TO LAST MENU OR DISPLAY SET-UP SELECTED
FINISHED?
NO
A
YES
C

FIGURE 5-42B. STORE FILE OPERATION

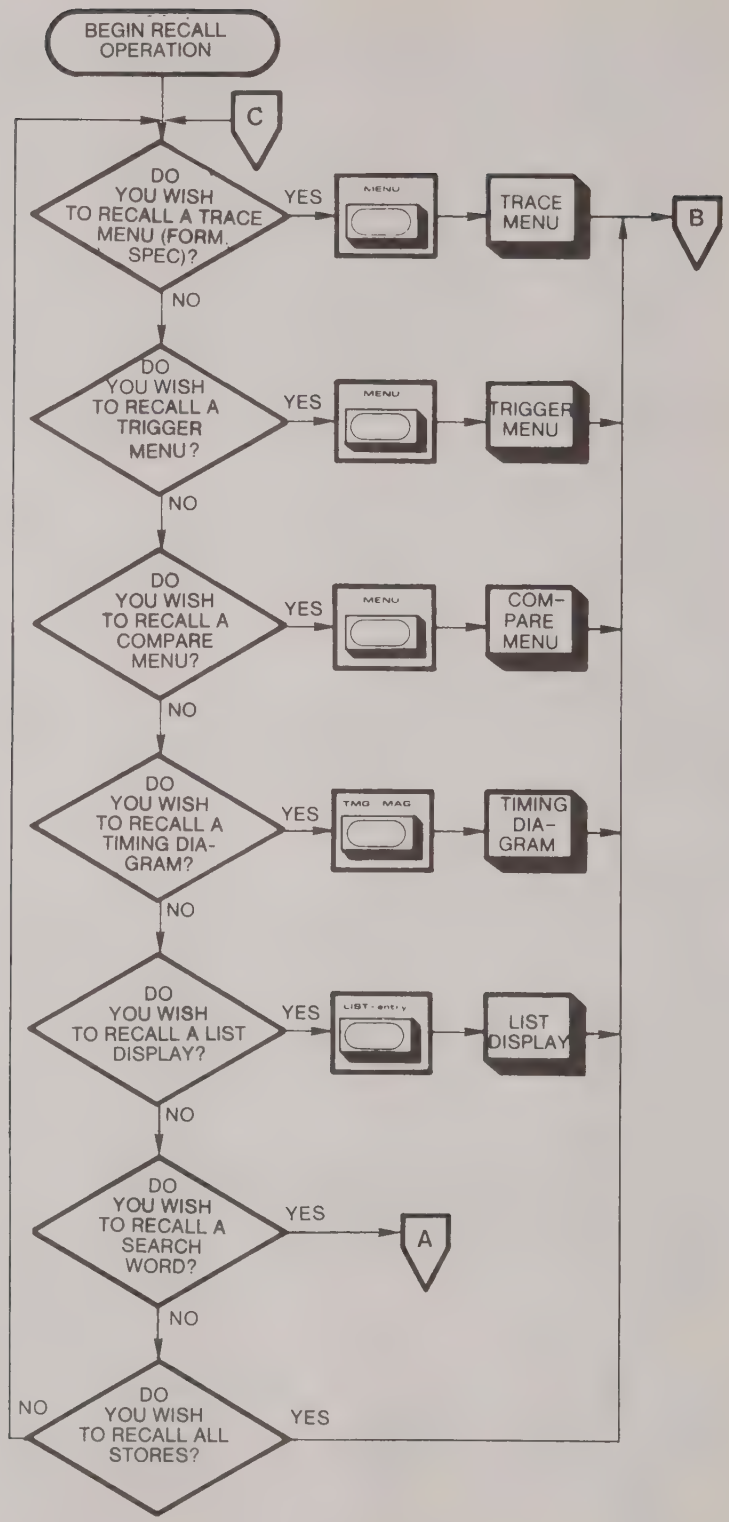



FIGURE 5-43A. RECALL FILE OPERATION

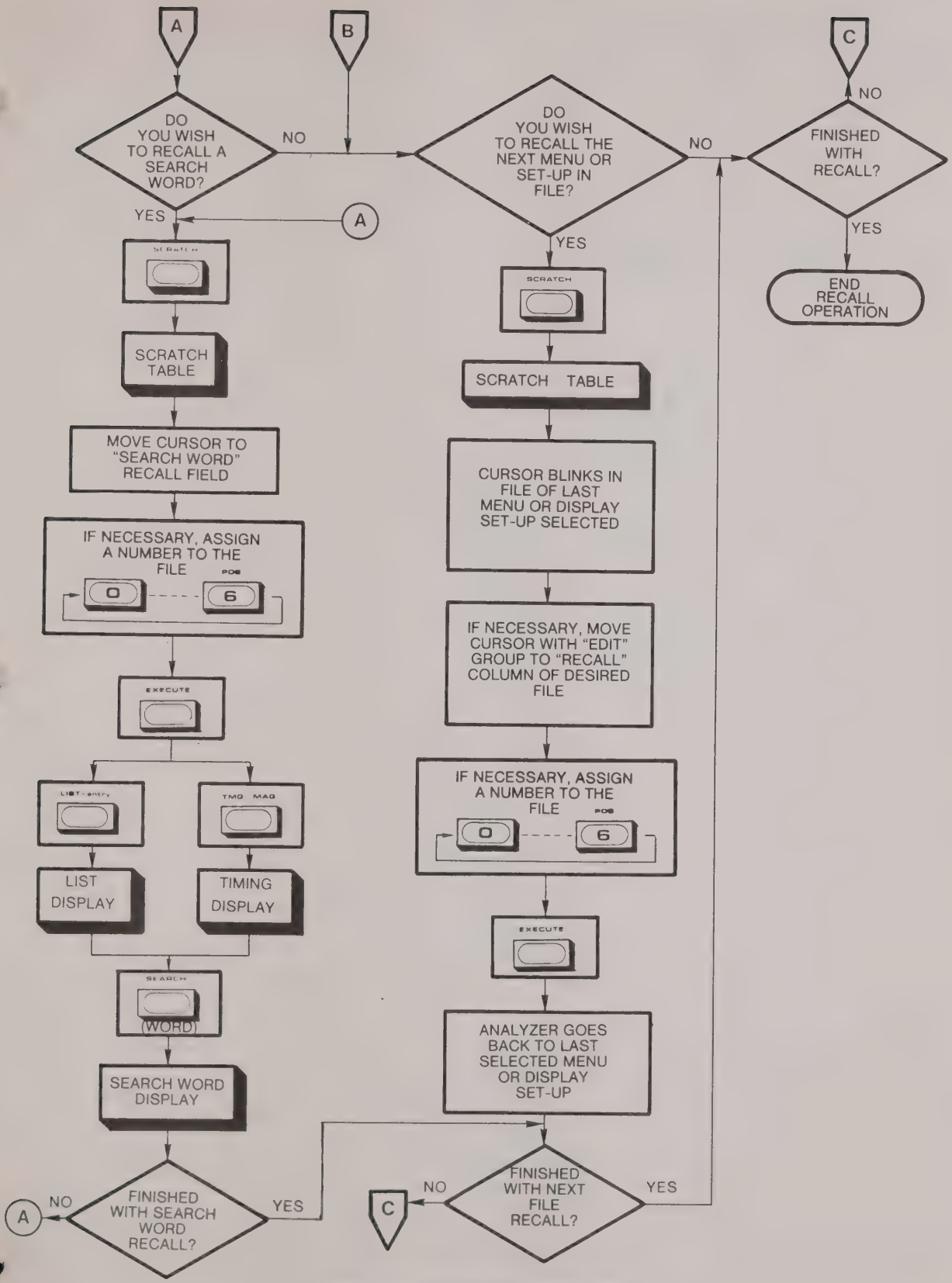



FIGURE 5-43B. RECALL FILE OPERATION

78343N

NOTES

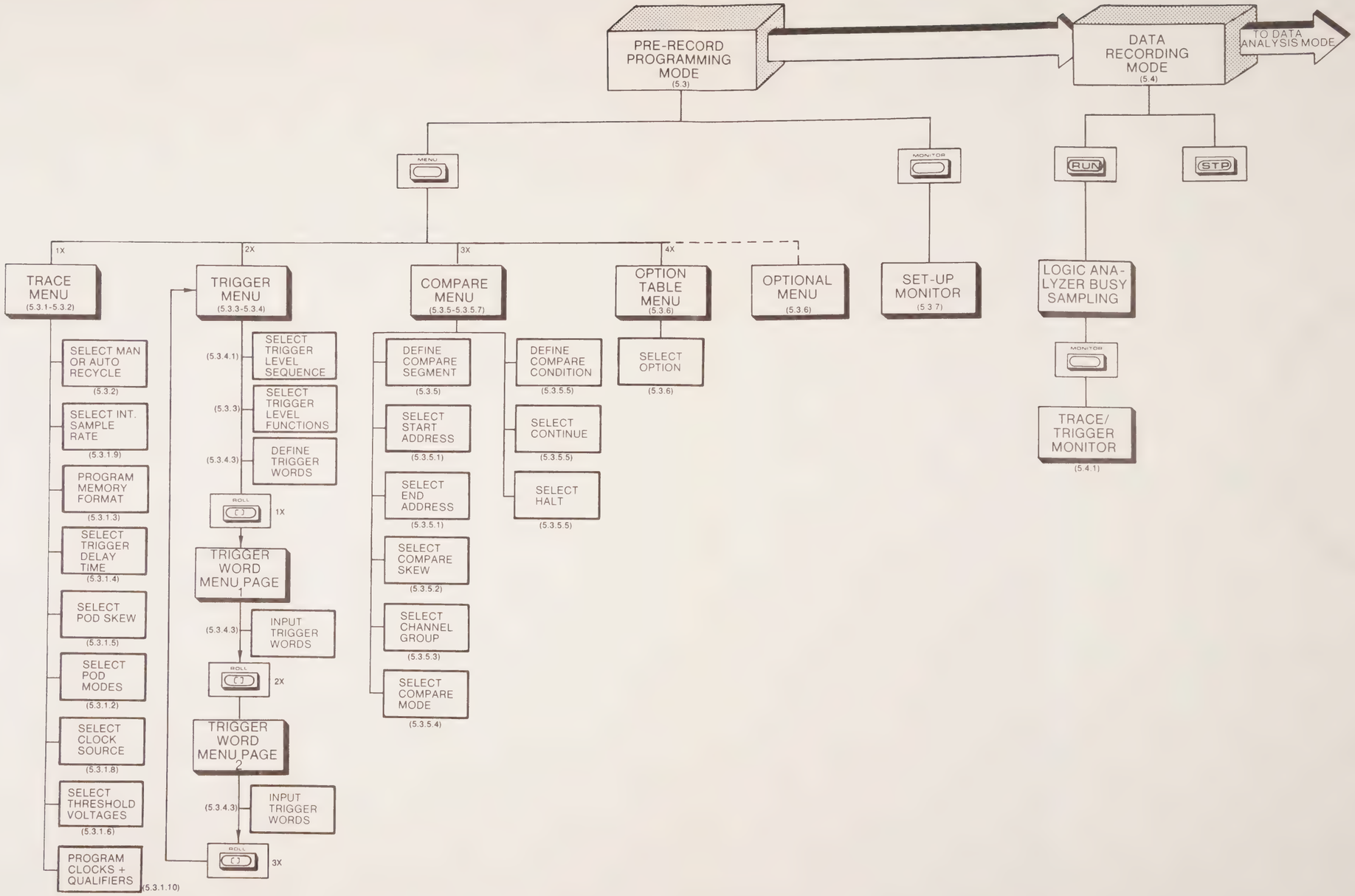



FIGURE 5-1A. FUNCTIONAL FAMILY TREE

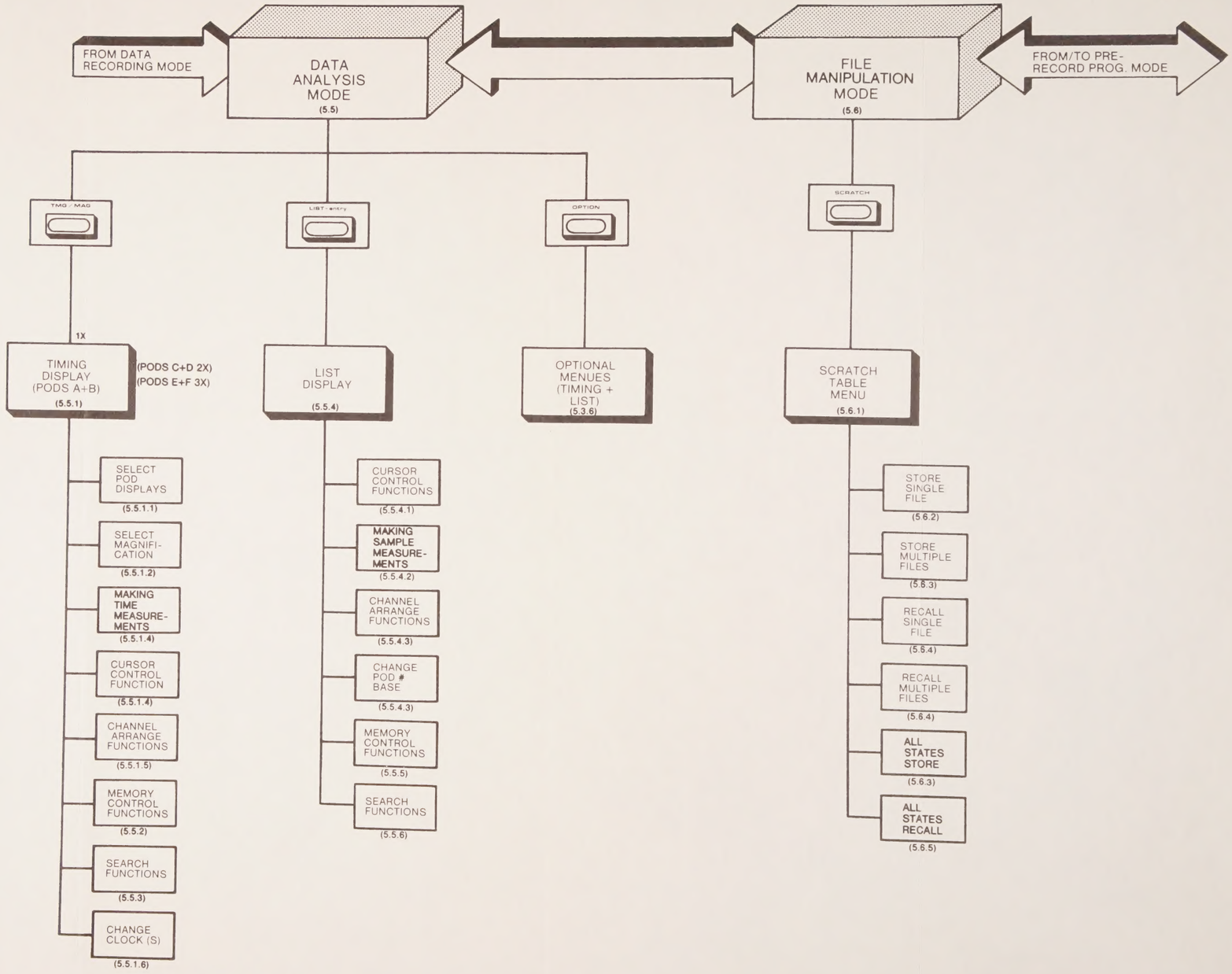



FIGURE 5-1B. FUNCTIONAL FAMILY TREE

Dear Customer,

In our ongoing effort to provide better products, **DLI** has developed a new concept in documentation. This concept divides OPERATION and MAINTENANCE into separate functions and provides detailed information for each.

We consider each of our customers an invaluable part of the **DLI** team, and we would appreciate your critique of our new documentation. With your assistance, we will be able to supply even better documentation and product support in the future.

Thank you,

**Technical Publications**

---


DOLCH
LOGIC INSTRUMENTS

3052 Orchard Drive San Jose, CA 95134 (408) 945-1881


NAME: _____

TITLE: _____

COMPANY: _____

ADDRESS: _____

CITY: _____ STATE: _____ ZIP _____

MANUAL IS: ☐ COMPLETE ☐ INCOMPLETE

☐ EXCELLENT ☐ GOOD ☐ FAIR ☐ POOR

MOST VALUABLE SECTION IS: ☐1 ☐2 ☐3 ☐4 ☐5 ☐6

WHAT CHANGES DO YOU RECOMMEND FOR THIS MANUAL, AND WHY? _____

REMARKS: _____

THIS MANUAL PERTAINS TO THE... ☐1650 ☐3250 ☐4850 ☐4850A ☐64300 ☐9600

_____ OTHER